RCA
Solid
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-REL TYPES · HIGH-REL TYPES · HIGH-REL TYPES · HIGH-REL TYPES ·

Power Devices

RCA Power Devices

This DATABOOK contains complete technical information on the full line of RCA solid-state power devices: power transistors, rf power hybrid circuits, triacs, SCR's, diacs, silicon rectifiers, and rectifier assemblies. A complete index of these types is included on the following pages.

The index to devices is followed by a series of product selection charts that provide a quick reference to key parameters and device packages to facilitate type selection. A cross-reference guide then indicates recommended RCA replacements for more than 2000 popular industry types. Next, general operating considerations for solid-state power devices are discussed, and symbols and special terms used to characterize these devices are listed.

The DATABOOK also contains eight data sections that provide detailed ratings and characteristics for each of the various types of devices. Data pages for individual devices are given as nearly as possible in alphanumerical sequence of the basic family type numbers. Because many devices may be included in the same basic family, individual type numbers are not necessarily in sequence. *If you don't find a type number where you expect it to be, check the Index to Devices.*

General information such as test circuits and waveforms, dimensional outlines, suggested mounting arrangements, and lead forms for plastic packages are included in an Appendix at the back of the book. The Appendix also includes abstracts of relevant RCA application notes. The final pages contain listings of RCA sales offices, manufacturers' representatives, and authorized distributors.

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RCA Solid State|Box 3200|Somerville, N.J., U.S.A. 08876
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Index to Devices

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BR = Bridge rectifier
D = Diac
GTO = Gate-turn-off SCR
ITR = Integrated thyristor/rectifier
PH = Power hybrid circuit
PT = Power transistor
R = Rectifier
RA = Rectifier assembly
RF = RF power transistor

Index to Devices

SCR = Silicon controlled rectifier
TRI = Triac

* JAN-type versions also available.

Power Transistor Selection Charts

N-P-N SILICON POWER TRANSISTORS

Type No.	DATA-BOOK Page No.	$V_{CEO}(sus)$ V	Current Gain			P_T (Max.) W	I_C (Max.) A	f_T MHz	Sw. Times▲		Package	p-n-p Complement
			h_{FE}	I_C A	V_{CE} V				t_{ON} µs	t_f µs		
I_C(Max.) = 0.15 to 1 A, f_T = 3 to 25 MHz												
40346	82	175	25 min.	0.010	10	10	1	15	–	–	TO-39	–
41505◆	164	200	20 min.	0.050	10	20	1	21	–	–	Plastic TO-5	–
2N3440	82	250	40-160	0.020	10	10	1	15	–	–	TO-39	2N5415
40412	82	250*	40 min.	0.030	20	10	1	15	–	–	TO-39	–
TIP47	342	250	10 min.	1	10	40	1	5	0.2	0.5	TO-220AB	–
40321	219	300*	25-200	0.020	10	5	1	15	–	–	TO-39	–
TIP48	342	300	10 min.	1	10	40	1	5	0.2	0.5	TO-220AB	–
2N3439	82	350	40-160	0.020	10	10	1	15	–	–	TO-39	2N5416
TIP49	342	350	10 min.	1	10	40	1	5	0.2	0.5	TO-220AB	–
TIP50	342	400	10 min.	1	10	40	1	5	0.2	0.5	TO-220AB	–
I_C(Max.) = 0.15 to 1 A, f_T = 50 to 100 MHz												
41502	54	30	20 min.	0.150	10	3	1	60	–	–	TO-39	41503
2N3053	54	40	50-250	0.150	10	5	1	60	–	–	TO-39	2N4037
2N3053A	54	60	50-250	0.150	10	5	0.7	60	–	–	TO-39	–
2N2102	54	65	25 min.	0.500	10	5	1	60	30 ns⊕	–	TO-39	2N4036
RCP115	319	100	50 min.	0.025	10	6.25	0.150	80	–	–	TO-202AB	–
RCP117	319	100	20 min.	0.025	10	6.25	0.150	80	–	–	TO-202AB	–
RCP111A	319	200	50-300	0.025	10	6.25	0.150	80	–	–	TO-202AB	–
RCP113A	319	200	30-150	0.025	10	6.25	0.150	80	–	–	TO-202AB	–
RCP111B	319	250	50-300	0.025	10	6.25	0.150	80	–	–	TO-202AB	–
RCP113B	319	250	30-150	0.025	10	6.25	0.150	80	–	–	TO-202AB	–
RCP115B	319	250	50 min.	0.025	10	6.25	0.150	80	–	–	TO-202AB	–
RCP117B	319	250	20 min.	0.025	10	6.25	0.150	80	–	–	TO-202AB	–
RCP111C	319	300	50-300	0.025	10	6.25	0.150	80	–	–	TO-202AB	–
RCP113C	319	300	30-150	0.025	10	6.25	0.150	80	–	–	TO-202AB	–
RCP111D	319	350	50-300	0.025	10	6.25	0.150	80	–	–	TO-202AB	–
RCP113D	319	350	30-150	0.025	10	6.25	0.150	80	–	–	TO-202AB	–
I_C(Max.) = 1.5 to 2 A, f_T = 0.2 to 1.5 MHz												
2N1479	60	40	20-60	0.200	4	5	1.5	1.4	1.2	1	TO-39#	–
2N1481	60	40	35-100	0.200	4	5	1.5	1.4	1.2	1	TO-39#	–
40347	60	40	20-150	0.450	4	8.75	1.5	1.5	–	–	TO-39#	–
2N1480	60	55	20-60	0.200	4	5	1.5	1.4	1.2	1	TO-39#	–
2N1482	60	55	35-100	0.200	4	5	1.5	1.4	1.2	1	TO-39#	–
40348	60	65	10 min.	1	4	8.75	1.5	1.5	–	–	TO-39#	–
40349	60	140	10 min.	0.450	4	8.75	1.5	0.9	–	–	TO-39#	–
I_C(Max.) = 1.5 to 2 A, f_T = 3 to 25 MHz												
BUX67	276	150	10-150	1	5	35	2	10	3	3	TO-66	BUX66
2N3584	93	250	8-80	1	2	35	2	10	3	3	TO-66	2N6211
BUX67A	276	250	10-150	1	5	35	2	10	3	3	TO-66	BUX66A
2N3585	93	300	8-80	1	2	35	2	10	3	3	TO-66	2N6212
2N4240	93	300	10-100	0.750	2	35	2	15	0.5	3	TO-66	–
BUX67B	276	300	10-150	1	5	35	2	10	3	3	TO-66	BUX66B
BUX67C	276	350	10-150	1	5	35	2	10	3	3	TO-66	BUX66C
I_C (Max.) = 1.5 to 2 A, f_T = 50 to 100 MHz												
RCP705	324	30	50 min.	0.500	4	10	2	50	80 ns	800 ns★	TO-202AB	RCP704
RCP707	324	30	20 min.	0.500	4	10	2	50	80 ns	800 ns★	TO-202AB	RCP706
RCP701A	324	40	50-250	0.500	4	10	2	50	80 ns	800 ns★	TO-202AB	RCP700A
RCP703A	324	40	30-150	0.500	4	10	2	50	80 ns	800 ns★	TO-202AB	RCP702A
2N5321	121	50	40-250	0.500	4	10	2	50	80 ns	800 ns★	TO-39	2N5323
2N6179	168	50	40-250	0.500	4	25	2	50	80 ns	800 ns★	Plastic TO-5	2N6181
RCP701B	324	60	50-250	0.500	4	10	2	50	80 ns	800 ns★	TO-202AB	RCP700B
RCP703B	324	60	30-150	0.500	4	10	2	50	80 ns	800 ns★	TO-202AB	RCP702B
RCP705B	324	60	50 min.	0.500	4	10	2	50	80 ns	800 ns★	TO-202AB	RCP704B
RCP707B	324	60	20 min.	0.500	4	10	2	50	80 ns	800 ns★	TO-202AB	RCP706B
2N5320	121	75	30-130	0.500	4	10	2	50	80 ns	800 ns★	TO-39	2N5322
2N6178	168	75	30-130	0.500	4	25	2	50	80 ns	800 ns★	Plastic TO-5	2N6180
RCP701C	324	80	50-250	0.500	4	10	2	50	80 ns	800 ns★	TO-202AB	RCP700C
RCP703C	324	80	30-150	0.500	4	10	2	50	80 ns	800 ns★	TO-202AB	RCP702C
RCA1A03	280	95*	70-300	0.300	4	10	2	50	–	–	TO-39	RCA1A04
RCP701D	324	100	50-250	0.500	4	10	2	50	80 ns	800 ns★	TO-202AB	RCP700D
RCP703D	324	100	30-150	0.500	4	10	2	50	80 ns	800 ns★	TO-202AB	RCP702D

▲ Measured at same current level as h_{FE} unless otherwise indicated   * $V_{CER}(sus)$ ⊕ $t_d + t_r + t_f$ ★ t_{OFF}

Also available in JEDEC TO-5 package

◆Check availability in Europe, the Middle East, and Africa.

N-P-N SILICON POWER TRANSISTORS (cont'd)

Type No.	DATA-BOOK Page No.	V_{CEO}(sus) V	Current Gain h_{FE}	I_C A	V_{CE} V	P_T (Max.) W	I_C (Max.) A	f_T MHz	Sw. Times▲ t_{ON} µs	t_f µs	Package	p-n-p Complement
I_C (Max.) = 2.5 to 5 A, f_T = 0.2 to 1 MHz												
2N1483	65	40	20-60	0.750	4	25	3	0.8	1.2	1.1	TO-8	–
2N1485	65	40	35-100	0.750	4	25	3	0.8	1.2	1.1	TO-8	–
2N5786	135	40	20-100	1.6	2	10	3.5	1	5○	15★	TO-39#	2N5783
2N5295	117	40	30-120	1	4	36	4	0.8	5	15★	TO-220AA	2N6108
2N5296	117	40	30-120	1	4	36	4	0.8	5	15★	TO-220AB	2N6109
2N6260	69	40	3 min.	4	2	29	3	0.8	–	–	TO-66	–
40250	69	40	25 min.	1.5	4	29	4	1	–	–	TO-66	2N5956
RCA29/SDH ♦	349	40	15 min.	1	4	36	4	0.8	2.3	6★	TO-220AB	–
RCA31/SDH ♦	349	40	25 min.	1	4	36	4	0.8	2.3	6★	TO-220AB	–
2N5785	135	50	20-100	1.2	2	10	3.5	1	5○	15★	TO-39#	2N5782
2N1484	65	55	20-80	0.750	4	25	3	0.8	1.2	1.1	TO-8	–
2N1486	65	55	35-100	0.750	4	25	3	0.8	1.2	1.1	TO-8	–
2N3054	69	55	5 min.	3	4	25	4	0.8	–	–	TO-66	2N5955
RCA3054	117	55	5 min.	3	4	36	4	0.8	–	–	TO-220AB	–
BDY71	259	55	5 min.	3	4	29	4	0.8	–	–	TO-66	–
2N5297	117	60	20-80	1.5	4	36	4	0.8	5	15★	TO-220AA	2N6106
2N5298	117	60	20-80	1.5	4	36	4	0.8	5	15★	TO-220AB	2N6107
RCA29A/SDH ♦	349	60	15 min.	1	4	36	4	0.8	2.3	6★	TO-220AB	–
RCA31A/SDH ♦	349	60	25 min.	1	4	36	4	0.8	2.3	6★	TO-220AB	–
2N5784	135	65	20-100	1	2	10	3.5	1	5	15★	TO-39#	2N5781
2N5293	117	70	30-120	0.5	4	36	4	0.8	5	15★	TO-220AA	2N6106
2N5294	117	70	30-120	0.5	4	36	4	0.8	5	15★	TO-220AB	2N6107
2N6261	69	80	5 min.	4	2	50	4	0.8	–	–	TO-66	–
RCA29B/SDH ♦	349	80	15 min.	4	4	36	4	0.8	2.3	6★	TO-220AB	–
RCA31B/SDH ♦	349	80	25 min.	4	4	36	4	0.8	2.3	6★	TO-220AB	–
RCA29C/SDH ♦	349	100	15 min.	1	4	50	2.5	0.8	2.3	6★	TO-220AB	–
RCA31C/SDH ♦	349	100	25 min.	1	4	50	2.5	0.8	2.3	6★	TO-220AB	–
2N6477	85	120	5 min.	2.5	4	50	2.5	0.2	–	–	TO-220AB	–
2N6263	85	120	3 min.	3	2	20	3	0.2	–	–	TO-66	2N6468
RCA6263	198	120	20-150	0.5	4	36	3	0.2	–	–	TO-220AB	–
2N4347	89	120	10 min.	5	4	100	5	0.2	–	–	TO-3	2N6248
2N6478	198	140	5 min.	2.5	4	50	2.5	0.2	–	–	TO-220AB	–
2N3441	85	140	5 min.	2.7	4	25	3	0.2	–	–	TO-66	2N6468
RCA3441	198	140	20-150	0.5	4	36	3	0.2	–	–	TO-220AB	–
2N6264	85	150	5 min.	3	2	50	3	0.2	–	–	TO-66	–
I_C = 2.5 to 5 A, f_T = 3 to 25 MHz												
RCA29 ♦	349	40	15-150	1	4	30	3	3	0.4	1.2★	TO-220AB	RCA30
RCA31 ♦	349	40	25 min.	1	4	40	5	3	0.4	1.2★	TO-220AB	RCA32
RCS29 ♦	349	40	15-150	1	4	30	3	3	0.4	1.2★	TO-66	RCS30
RCS31 ♦	349	40	25 min.	1	4	40	5	3	0.4	1.2★	TO-66	RCS32
TIP29	330	40	15-150	1	4	30	3	3	0.4	1.2★	TO-220AB	TIP30
TIP31	334	40	25 min.	1	4	40	5	3	0.4	1.2★	TO-220AB	TIP32
BD239	240	45	15 min.	1	4	30	4	3	–	–	TO-220AB	BD240
BD241	242	45	25 min.	1	4	40	5	3	–	–	TO-220AB	BD242
BD239A	240	60	15 min.	1	4	30	4	3	–	–	TO-220AB	BD240A
BD241A	242	60	25 min.	1	4	40	5	3	–	–	TO-220AB	BD242A
RCA29A ♦	349	60	15-150	1	4	30	3	3	0.4	1.2★	TO-220AB	RCA30A
RCA31A ♦	349	60	25 min.	1	4	40	5	3	0.4	1.2★	TO-220AB	RCA32A
TIP29A	330	60	15-150	1	4	30	3	3	0.4	1.2★	TO-220AB	TIP30A
TIP31A	334	60	25 min.	1	4	40	5	3	0.4	1.2★	TO-220AB	TIP32A
BD239B	240	80	15 min.	1	4	30	4	3	–	–	TO-220AB	BD240B
BD241B	242	80	25 min.	1	4	40	5	3	–	–	TO-220AB	BD242B
RCA29B ♦	349	80	15-150	1	4	30	3	3	0.4	1.2★	TO-220AB	RCA30B
RCA31B ♦	349	80	25 min.	1	4	40	5	3	0.4	1.2★	TO-220AB	RCA32B
TIP29B	330	80	15-150	1	4	30	3	3	0.4	1.2★	TO-220AB	TIP30B
TIP31B	334	80	25 min.	1	4	40	5	3	0.4	1.2★	TO-220AB	TIP32B
2N6465	141	100	5 min.	4	4	40	4	5	–	–	TO-66	2N6467
2N6473	157	100	2 min.	4	2.5	40	4	4	–	–	TO-220AB	2N6475

▲ Measured at same current level as h_{FE} unless otherwise indicated * V_{CER}(sus) ★ t_{OFF}

\# Also available in JEDEC TO-5 package ○ At I_C = 1A

♦ Check availability in Europe, the Middle East, and Africa.

Power Transistor Selection Charts

N-P-N SILICON POWER TRANSISTORS (cont'd)

Type No.	DATA-BOOK Page No.	$V_{CEO(sus)}$ V	Current Gain			P_T (Max.) W	I_C (Max.) A	f_T MHz	Sw. Times▲		Package	p-n-p Complement
			h_{FE}	I_C A	V_{CE} V				t_{ON} µs	t_f		
I_C = 2.5 to 5 A, f_T = 3 to 25 MHz												
BD239C	240	100	15 min.	1	4	30	4	3	–	–	TO-220AB	BD240C
BD241C	242	100	25 min.	1	4	40	5	3	–	–	TO-220AB	BD242C
RCA29C ♦	349	100	15-150	1	4	30	3	3	0.4	1.2★	TO-220AB	RCA30C
RCA31C ♦	349	100	25 min.	1	4	40	5	3	0.4	1.2★	TO-220AB	RCA32C
TIP29C	330	100	15-150	1	4	30	3	3	0.4	1.2★	TO-220AB	TIP30C
TIP31C	334	100	25 min.	1	4	40	5	3	0.4	1.2★	TO-220AB	TIP32C
2N6466	157	120	5 min.	4	4	40	4	5	–	–	TO-66	2N6468
2N6474	157	120	2 min.	4	2.5	40	4	4	–	–	TO-220AB	2N6476
BUX16	268	200	5 min.	4.5	10	100	5	5	–	–	TO-3	–
2N5239	114	225	5 min.	4.5	10	100	5	5	–	–	TO-3	–
2N5838	139	250	8-40	3	2	100	3	5	0.86	0.4	TO-3	–
BU133	267	250	15-80	1	5	80	3	3.5	–	0.5	TO-3	–
BUX16A	268	250	5 min.	4.5	10	100	5	5	–	–	TO-3	–
2N5839	139	275	10-50	2	3	100	3	5	0.67	0.35	TO-3	–
2N5240	114	300	5 min.	4.5	10	100	5	5	–	–	TO-3	–
BU126	267	300	15-60	1	5	80	3	3.5	–	0.5	TO-3	–
BUX16B	268	300	5 min.	4.5	10	100	5	5	–	–	TO-3	–
2N5840	139	350	10-50	2	3	100	3	5	0.67	0.35	TO-3	–
BUX16C	268	350	5 min.	4.5	10	100	5	5	–	–	TO-3	–
I_C = 2.5 to 5 A, f_T = 50 to 100 MHz												
2N3878	103	50	20 min.	4	5	35	4	40	–	–	TO-66	–
2N5202	103	50	10-100	4	1.2	35	4	60	0.44	0.4	TO-66	–
2N6500	103	90	15-60	3	2	35	4	60	0.44	0.5	TO-66	–
I_C = 6 to 10 A, f_T = 0.2 to 1 MHz												
2N1487	67	40	15-45	1.5	4	75	6	0.8	–	–	TO-3	–
2N1489	67	40	25-75	1.5	4	75	6	0.8	–	–	TO-3	–
2N5490	127	40	20-100	2	4	50	7	0.8	5	15★	TO-220AB	2N6109
2N5491	127	40	20-100	2	4	50	7	0.8	5	15★	TO-220AA	2N6108
2N5494	127	40	20-100	3	4	50	7	0.8	5	15★	TO-220AB	2N6109
2N5495	127	40	20-100	3	4	50	7	0.8	5	15★	TO-220AA	2N6108
BD278	247	45	15-75	4	4	75	10	0.8	–	–	TO-220AB	–
2N1488	67	55	15-45	1.5	4	75	6	0.8	–	–	TO-3	–
2N1490	67	55	25-75	1.5	4	75	6	0.8	–	–	TO-3	–
2N5492	127	55	20-100	2.5	4	50	7	0.8	5	15★	TO-220AB	2N6107
2N5493	127	55	20-100	2.5	4	50	7	0.8	5	15★	TO-220AA	2N6106
2N6098	154	60	5 min.	10	4	75	10	0.8	–	–	TO-220AA	–
2N6099	154	60	5 min.	10	4	75	10	0.8	–	–	TO-220AB	–
BD278A	247	60	15-75	4	4	75	10	0.8	–	–	TO-220AB	–
RCA41A/SDH ♦	349	60	15 min.	3	4	75	10	0.8	3.2●	3.7★●	TO-220AB	–
2N5496	127	70	20-100	3.5	4	50	7	0.8	5	15★	TO-220AB	2N6107
2N5497	127	70	20-100	3.5	4	50	7	0.8	5	15★	TO-220AA	2N6106
2N6100	154	70	20-80	5	4	75	10	0.8	–	–	TO-220AA	–
2N6101	154	70	20-80	5	4	75	10	0.8	–	–	TO-220AB	–
RCA41B/SDH ♦	349	80	15 min.	3	4	75	10	0.8	3.2●	3.7★●	TO-220AB	–
2N4348	99	120	10 min.	10	4	120	10	0.2	–	–	TO-3	2N6248
2N3442	89	140	7.5 min.	10	4	117	10	0.8	–	–	TO-3	–
2N6262	89	150	5 min.	10	2	150	10	0.8	–	–	TO-3	–
2N6078	149	250	12-70	1.2	1	45	7	1	0.32	0.3	TO-66	–
2N6077	150	275	12-70	1.2	1	45	7	1	0.32	0.3	TO-66	–
2N6079	150	350	12-50	1.2	1	45	7	1	0.32	0.3	TO-66	–
I_C = 6 to 10 A, f_T = 2.5 to 25 MHz												
41500	157	25	25 min.	1	4	40	7	4	–	–	TO-220AB	41501
2N6288	157	30	2.3 min.	7	4	40	7	4	–	–	TO-220AB	2N6111
2N6289	157	30	2.3 min.	7	4	40	7	4	–	–	TO-220AA	2N6110
2N6374	157	40	5 min.	6	4	40	6	4	–	–	TO-66	2N5956
RCA41 ♦	349	40	15-150	3	4	65	7	3	0.6●	1.4★●	TO-220AB	RCA42
TIP41	338	40	15-150	3	4	65	7	3	0.6●	1.4★●	TO-220AB	TIP42
BD243	244	45	15 min.	3	4	65	7	2	—	—	TO-220AB	BD244
2N6290	157	50	2.3 min.	7	4	40	7	4	—	—	TO-220AB	2N6109

▲ Measured at same current level as h_{FE} unless otherwise indicated ● At I_C = 6A ★ t_{OFF}

♦Check availability in Europe, the Middle East, and Africa.

Power Transistor Selection Charts

N-P-N SILICON POWER TRANSISTORS (cont'd)

Type No.	DATA-BOOK Page No.	V_{CEO}(sus) V	Current Gain			P_T (Max.) W	I_C (Max.) A	f_T MHz	Sw. Times▲		Package	p-n-p Complement
			h_{FE}	I_C A	V_{CE} V				t_{ON} µs	t_f		
I_C = 6 to 10 A, f_T = 2.5 to 25 MHz (cont'd)												
BD243	244	45	15 min.	3	4	65	7	2	—	—	TO-220AB	BD244
2N6290	157	50	2.3 min.	7	4	40	7	4	—	—	TO-220AB	2N6109
2N6291	157	50	2.3 min.	7	4	40	7	4	—	—	TO-222AA	2N6108
2N6373	142	60	5 min.	6	4	40	6	4	—	—	TO-66	2N5955
BD243A	244	60	15 min.	3	4	65	7	3	—	—	TO-220AB	BD244A
RCA41A♦	349	60	15-150	3	4	65	7	3	0.6●	1.4★●	TO-220AB	RCA42A
TIP41A		60	15-150	3	4	65	7	3	0.6●	1.4★●	TO-220AB	—
2N6292	157	70	2.3 min.	7	4	40	7	4	—	—	TO-220AB	2N6107
2N6293	157	70	2.3 min.	7	4	40	7	4	—	—	TO-220AA	2N6106
2N6372	142	80	5 min.	6	4	40	6	4	—	—	TO-66	2N5954
BD243B	244	80	15 min.	3	4	65	7	3	—	—	TO-220AB	BD244B
RCA41B	349	80	15-150	3	4	65	7	3	0.6●	1.4★●	TO-220AB	RCA42B
TIP41B	338	80	15-150	3	4	65	7	3	0.6●	1.4★●	TO-220AB	—
BD243C	244	100	15 min.	3	4	65	7	3	—	—	TO-220AB	BD244C
RCA41C	349	100	15-150	3	4	65	7	3	0.6●	1.4★●	TO-220AB	RCA42C
TIP41C	338	100	15-150	3	4	65	7	3	0.6●	1.4★●	TO-220AB	—
BU106	265	140	8 min.	4	5	75	7	3	—	1.5	TO-3	—
BUX17	271	150	7 min.	10	3	150	10	2.5	2	1	TO-3	—
2N6249	178	200	10-50	10	3	175	10	8	0.8@	0.5	TO-3	—
2N6510	206	200	10-50	3	3	120	7	3	0.8	0.5	TO-3	—
BUX18	274	200	7 min.	6	3	120	8	3	—	0.6🌢	TO-3	—
RCA410	349	200	30 min.	1	5	125	7	4	0.35@	0.15	TO-3	—
2N6306	185	250	15-75	3	5	125	8	5	0.6@	0.4	TO-3	—
2N6511	206	250	10-50	4	3	120	7	3	0.8	0.5	TO-3	—
BUX17A	271	250	7 min.	10	3	150	10	2.5	2	1	TO-3	—
RCS579♦	185	250	12 min.	3	5	125	8	5	0.6@	0.4	TO-3	—
2N6250	178	275	8-50	10	3	175	10	8	0.8@	0.5	TO-3	—
BUX18A	274	275	7 min.	5	3	120	8	3	—	0.6🌢	TO-3	—
2N6307	185	300	15-75	3	5	125	8	5	0.6@	0.4	TO-3	—
2N6512	206	300	10-50	4	3	120	7	3	1.7	1.5	TO-3	—
2N6514	206	300	10-50	5	3	120	7	3	0.8	0.5	TO-3	—
BUX17B	271	300	7 min.	8	3	150	10	2.5	2	1	TO-3	—
RCA411	349	300	30-90	1	5	125	7	2.5	0.35@	0.15	TO-3	—
RCA8767	313	300	8 min.	6	3	175	10	20	0.4@	0.3	TO-3	—
BUX18B	274	325	10 min.	4	3	120	8	3	—	0.6🌢	TO-3	—
RCA413	349	325	15 min.	1	5	125	7	4	0.35@	0.15	TO-3	—
RCA423	349	325	30-90	1	5	125	7	4	0.35@	0.15	TO-3	—
RCA431	349	325	15-35	2.5	5	125	7	4	0.35@	0.15	TO-3	—
2N6251	178	350	6-50	10	3	175	10	8	0.8@	0.5	TO-3	—
2N6308	185	350	12-60	3	5	125	8	5	0.6@	0.4	TO-3	—
2N6513	206	350	10-50	4	3	120	7	3	0.8	0.5	TO-3	—
BUX17C	271	350	7 min.	8	3	150	10	2.5	2	1	TO-3	—
BUX18C	274	375	10 min.	4	3	120	8	3	—	0.6🌢	TO-3	—
RCA8766	310	350	100 min.	6	3	150	10	10	–	–	TO-3	—
RCA8766A	310	350	100 min.	4	3	150	10	10	–	–	TO-3	—
RCA8767A	313	350	8 min.	6	3	175	10	20	0.4@	0.3	TO-3	—
BUX18C	274	375	10 min.	4	3	120	8	3	–	0.6🌢	TO-3	—
RCA8766B	310	400	100 min.	6	3	150	10	10	–	–	TO-3	—
RCA8766C	310	400	100 min	4	3	150	10	10	–	–	TO-3	—
RCA8767B	313	400	8 min.	6	3	175	10	20	0.4@	0.3	TO-3	—
RCA8766D	310	450	100 min.	6	3	150	10	10	–	–	TO-3	—
RCA8766E	310	450	100 min.	4	3	150	10	10	–	–	TO-3	—
I_C = 6 to 10 A, f_T = 50 to 100 MHz												
2N3879	103	75	12-100	4	2	35	7	60	0.44	0.4	TO-66	—
2N6354	109	120	2 min.	10	2	140	10	80	1@	0.2	TO-3	—
I_C = 12 to 20 A, f_T = 0.2 to **1.5 MHz**												
2N6102	154	40	5 min.	16	4	75	16	0.8	—	—	TO-220AA	—
2N6103	154	40	5 min.	16	4	75	16	0.8	—	—	TO-220AB	—
2N6257	98	40	5 min.	20	4	150	20	0.2	—	—	TO-3	—
2N6371	76	40	4 min.	16	4	117	16	0.8	—	—	TO-3	2N6469
2N6569	73	40	5-100	5	4	100	12	1.5	1.9■	1.5■	TO-3	2N6594
RCA41/SDH♦	349	40	15 min.	3	4	75	16	0.8	3.23@	3.7★●	TO-220AB	—
2N6253	76	45	3 min.	15	4	115	15	0.8	—	—	TO-3	—
BD142	235	45	12.5-160	4	4	117	15	0.8	—	—	TO-3	—
BD181	237	45	20-70	3	4	117	15	0.8	—	—	TO-3	—
2N3055H	76	60	5 min.	10	4	115	15	0.8	—	—	TO-3	2N6246
2N3772	98	60	5 min.	20	4	150	20	0.2	—	—	TO-3	2N6246
BD182	237	60	20-70	4	4	117	15	0.8	—	—	TO-3	—
RCA3055	154	60	5 min.	10	4	75	15	0.8	—	—	TO-220AB	—

▲ Measured at same current level as h_{FE} unless otherwise indicated

♦Check availability in Europe, the Middle East, and Africa.

● At I_C = 6A

■At I_C = 2A

🌢 At I_C = 4A

@ t_r

★ t_{OFF}

Power Transistor Selection Charts

N-P-N SILICON POWER TRANSISTORS (cont'd)

Type No.	DATA-BOOK Page No.	V_{CEO}(sus) V	Current Gain h_{FE}	Current Gain I_C A	Current Gain V_{CE} V	P_T (Max.) W	I_C (Max.) A	f_T MHz	Sw. Times▲ t_{ON} µs	Sw. Times▲ t_f µs	Package	p-n-p Complement
I_C = 12 to 20 A, f_T = 0.2 to 1.5 MHz (cont'd)												
RCS258♦	48	60	5 min.	20	4	250	20	0.2	–	–	TO-3	–
40363	219	70*	20-70	4	4	115	15	0.7	–	–	TO-3	–
2N6254	76	80	5 min.	15	4	150	15	0.8	–	–	TO-3	–
BD183	237	80	20-70	3	4	117	15	0.8	–	–	TO-3	–
RCA1B01♦	284	95*	20-70	4	4	115	15	0.8	–	–	TO-3	–
2N3773	99	120	5 min.	16	4	150	16	0.2	–	–	TO-3	–
BDY37	257	140	15-60	8	4	150	16	0.2	–	–	TO-3	–
2N6259	99	150	10 min.	16	4	250	16	0.2	–	–	TO-3	–
I_C = 12 to 20 A, f_T = 2.5 to 25 MHz												
2N6470	174	40	5 min.	15	4	125	15	5	–	–	TO-3	2N6469
2N6486	204	40	5 min.	15	4	75	15	5	–	–	TO-220AB	2N6489
2N3055	73	60	20-70	4	4	115	15	2.5	1.9■	1.5■	TO-3	MJ2955
2N6471	174	60	5 min.	15	4	125	15	5	–	–	TO-3	2N6246
2N6487	204	60	5 min.	15	4	75	15	5	–	–	TO-220AB	2N6490
2N6472	174	80	5 min.	15	4	125	15	5	–	–	TO-3	2N6247
2N6488	204	80	5 min.	15	4	75	15	5	–	–	TO-220AB	2N6491
RCS617	73	80	20-70	5	4	115	15	2.5	1.9■	1.5■	TO-3	RCS618
RCA9113	315	300	15 min.	5	3	175	15	20	1.03*	0.75ˣ	TO-3/TO-204MA	–
RCA9113A	315	350	15 min.	5	3	175	15	20	1.03*	0.75ˣ	TO-3/TO-204MA	–
RCA9113B	315	400	15 min.	3	3	175	15	20	1.03*	0.75ˣ	TO-3/TO-204MA	–
I_C = 12 to 20 A, f_T = 50 to 100 MHz												
2N6479%■	201	60	20-300	12	2	87	12	100	–	–	Radial■	–
2N6481%	201	60	20-300	12	2	117	12	100	–	–	Radial	–
2N5039	109	75	20-100	10	5	140	20	60	0.5@	0.5	TO-3	–
2N6480%■	201	80	20-300	12	2	87	12	100	–	–	Radial■	–
2N6482%	201	80	20-300	12	2	117	12	100	–	–	Radial	–
2N5038	109	90	20-100	12	5	140	20	60	0.5@	0.5	TO-3	–
2N6496	109	110	12-100	8	2	140	15	60	0.5@	0.5	TO-3	–
I_C = 25 to 50 A, f_T = 0.2 to 1 MHz												
2N3771	98	40	5 min.	30	4	150	30	0.2	–	–	TO-3	–
BDY29	255	75	15-60	15	2	220	30	0.2	–	–	TO-3	–
I_C = 25 to 50 A, f_T = 2.5 to 25 MHz												
2N3264	80	60	20-80	15	3	125	25	20	0.5	0.5	Radial	–
2N3266	80	60	20-80	15	3	125	25	20	0.5	0.5	TO-63	–
2N3263	80	90	25-75	15	3	125	25	20	0.5	0.5	Radial	–
2N3265	80	90	25-75	15	3	125	25	20	0.5	0.5	TO-63	–
I_C = 25 to 50 A, f_T = 50 to 100 MHz												
2N6032	146	90	10-50	50	2.6	140	50	50	1@	0.5	Mod. TO-3	–
2N5671	133	90	20-100	15	2	140	30	50	0.5	0.5	TO-3	–
2N6033	147	120	10-50	40	2	140	40	50	1@	0.5	Mod. TO-3	–
2N5672	133	120	20-100	15	2	140	30	50	0.5	0.5	TO-3	–
$I_C \geqslant$ 60 A, f_T = 0.4 MHz												
2N5575	130	50	10-40	60	4	300	80	0.4	15	15	Mod. TO-3	–
2N5578	130	70	10-40	40	3	300	60	0.4	15	15	Mod. TO-3	–

P-N-P SILICON POWER TRANSISTORS

Type No.	DATA-BOOK Page No.	V_{CEO}(sus) V	Current Gain h_{FE}	Current Gain I_C A	Current Gain V_{CE} V	P_T (Max.) W	I_C (Max.) A	f_T MHz	Sw. Times▲ t_{ON} µs	Sw. Times▲ t_f µs	Package	n-p-n Complement
I_C = −0.15 to −1 A, f_T = 0.2 to 1 MHz												
BFT28	263	−100	20 min.	−0.010	−10	5	−1	25	–	–	TO-39	–
BFT19	261	−150	20 min.	−0.050	−10	5	−1	25	–	–	TO-39	–
BFT28A	263	−150	20 min.	−0.010	−10	5	−1	25	–	–	TO-39	–
RCS880♦	126	−150	20-150	−0.050	−10	7.5	−1	15	–	–	TO-39	–
2N5415	126	−200	30-150	−0.050	−10	10	−1	15	–	–	TO-39	2N3440
BFT28B	263	−200	20 min.	−0.010	−10	5	−1	25	–	–	TO-39	–
BFT19A	261	−250	20 min.	−0.050	−10	5	−1	25	–	–	TO-39	–
BFT28C	263	−250	20 min.	−0.010	−10	5	−1	25	–	–	TO-39	–
RC881♦	126	−250	20 min.	−0.035	−10	7.5	−1	15	–	–	TO-39	–
2N5416	126	−300	30-120	−0.050	−10	10	−1	15	–	–	TO-39	2N3439

▲ Measured at same current level as h_{FE} unless otherwise indicated   * V_{CER}(sus)   @ t_r ★ t_{OFF} ■ At I_C = 2A

% Radiation hardened   ■ Isolated Collector   x At I_C = 10A

♦Check availability in Europe, the Middle East, and Africa.

Power Transistor Selection Charts

P-N-P SILICON POWER TRANSISTORS (cont'd)

Type No.	DATA-BOOK Page No.	V_{CEO}(sus) V	Current Gain			P_T (Max.) W	I_C (Max.) A	f_T MHz	Sw. Times▲ µs		Package	n-p-n Complement
			h_{FE}	I_C A	V_{CE} V				t_{ON}	t_f		
I_C = −0.15 to −1 A, f_T = 0.2 to 1 MHz (cont'd)												
RCS882♦	126	−300	20 min.	−0.035	−10	7.5	−1	15	–	–	TO-39	–
BFT19B	261	−350	20 min.	−0.050	−10	5	−1	25	–	–	TO-39	–
I_C = −0.15 to −1 A, f_T = 50 to 100 MHz												
41503	106	−30	20 min.	−0.150	−10	7	−1	60	–	–	TO-39	41502
2N4037	106	−40	50-250	−0.150	−10	7	−1	60	–	–	TO-39	2N3053
2N4036	106	−65	40-140	−0.150	−10	7	−1	60	0.11	0.1	TO-39	2N2102
2N4314	106	−65	50-250	−0.150	−10	7	−1	60	–	–	TO-39	–
I_C = −1.5 to −2 A, f_T = 2.5 to 25 MHz												
BUX66	276	−150	10-150	−1	−5	35	−2	20	0.6@	0.6	TO-66	BUX67
2N6211	172	−225	10-100	−1	−2.8	20	−2	20	0.6@	0.6	TO-66	2N3584
BUX66A	276	−250	10-150	−1	−5	35	−2	20	0.6@	0.6	TO-66	BUX67A
2N6212	172	−300	10-100	−1	−3.2	20	−2	20	0.6@	0.6	TO-66	2N3585
BUX66B	276	−300	10-150	−1	−5	35	−2	20	0.6@	0.6	TO-66	BUX67B
2N6213	172	−350	10-100	−1	−4	20	−2	20	0.6@	0.6	TO-66	2N3585
BUX66C	276	−350	10-150	−1	−5	35	−2	20	0.6@	0.6	TO-66	BUX67C
2N6214	172	−400	10-100	−1	−5	20	−2	20	0.6@	0.6	TO-66	–
I_C = −1.5 to −2 A, f_T = 50 to 100 MHz												
RCP704	324	−30	50 min.	−0.5	−4	10	−2	50	0.1	1★	TO-202AB	RCP705
RCP706	324	−30	20 min.	−0.5	−4	10	−2	50	0.1	1★	TO-202AB	RCP707
RCP700A	324	−40	50-250	−0.5	−4	10	−2	50	0.1	1★	TO-202AB	RCP701A
RCP702A	324	−40	30-150	−0.5	−4	10	−2	50	0.1	1★	TO-202AB	RCP703A
2N5323	121	−50	40-250	−0.5	−4	10	−2	50	0.1	1★	TO-39	2N5321
2N6181	201	−50	40-250	−0.5	−4	25	−2	50	0.1	1★	Plastic TO-5	2N6179
RCP700B	324	−60	50-250	−0.5	−4	10	−2	50	0.1	1★	TO-202AB	RCP701B
RCP702B	324	−60	30-150	−0.5	−4	10	−2	50	0.1	1★	TO-202AB	RCP703B
RCP704B	324	−60	50 min.	−0.5	−4	10	−2	50	0.1	1★	TO-202AB	RCP705B
RCP706B	324	−60	20 min.	−0.5	−4	10	−2	50	0.1	1★	TO-202AB	RCP707B
2N5322	121	−75	30-130	−0.5	−4	10	−2	50	0.1	1★	TO-39	2N5320
2N6180	201	−75	30-150	−0.5	−4	25	−2	50	0.1	1★	Plastic TO-5	2N6178
RCP700C	324	−80	50-250	−0.5	−4	10	−2	50	0.1	1★	TO-202AB	RCP701C
RCP702C	324	−80	30-150	−0.5	−4	10	−2	50	0.1	1★	TO-202AB	RCP703C
RCA1A04♦	280	−95*	50 min.	−0.1	−4	10	−2	50	–	–	TO-39	RCA1A03
RCP700D	324	−100	50-250	−0.5	−4	10	−2	50	0.1	1★	TO-202AB	RCP701D
RCP702D	324	−100	30-150	−0.5	−4	10	−2	50	0.1	1★	TO-202AB	RCP703D
I_C = −2.5 to −5 A, f_T = 2.5 to 25 MHz												
2N5783	135	−40	4 min.	−3.2	−2	10	−3.5	8	0.5	2.5★	TO-39#	2N5786
RCA30♦	349	−40	15-150	−1	−4	30	−3	3	0.2	1★	TO-220AB	RCA29
RCA32♦	349	−40	25 min.	−1	−4	40	−5	3	0.2	1★	TO-220AB	RCA31
RCS30♦	349	−40	15-150	−1	−4	30	−3	3	0.2	1★	TO-66	RCS29
RCS32♦	349	−40	25 min.	−1	−4	40	−5	3	0.2	1★	TO-66	RCS31
TIP30	332	−40	15-150	−1	−4	30	−3	3	0.2	1★	TO-220AB	TIP29
TIP32	336	−40	25 min.	−1	−4	40	−5	3	0.2	1★	TO-220AB	TIP31
BD240	240	−45	15 min.	−1	−4	30	−4	3	–	–	TO-220AB	BD239
BD242	242	−45	25 min.	−1	−4	40	−5	3	–	–	TO-220AB	BD241
2N5782	135	−50	4 min.	−3.2	−4	10	−3.5	8	0.5	2.5★	TO-39#	2N5785
BD240A	240	−60	15 min.	−1	−4	30	−4	3	–	–	TO-220AB	BD239A
BD242A	242	−60	10 min.	−3	−4	40	−5	3	–	–	TO-220AB	BD241A
RCA30A♦	349	−60	15-150	−1	−4	30	−5	3	0.2	1★	TO-220AB	RCA29A
RCA32A♦	349	−60	25 min.	−1	−4	40	−5	3	0.2	1★	TO-220AB	RCA31A
RCS30A♦	349	−60	15-150	−1	−4	30	−3	3	0.2	1★	TO-66	RCS29A
RCS32A♦	349	−60	25 min.	−1	−4	40	−5	3	0.2	1★	TO-66	RCS31A
TIP30A	332	−60	15-150	−1	−4	30	−3	3	0.2	1★	TO-220AB	TIP29A
TIP32A	336	−60	25 min.	−1	−4	40	−5	3	0.2	1★	TO-220AB	TIP31A
2N5781	135	−65	20-100	−1	−2	10	−3.5	8	0.5	2.5★	TO-39#	2N5784
BD240B	240	−80	15 min.	−1	−4	30	−4	3	–	–	TO-220AB	BD239B
BD242B	242	−80	25 min.	−1	−4	40	−5	3	–	–	TO-220AB	BD241B
RCA30B♦	349	−80	15-150	−1	−4	30	−3	3	0.2	1★	TO-220AB	RCA29B
RCA32B♦	349	−80	25 min.	−1	−4	40	−5	3	0.2	1★	TO-220AB	RCA31B
RCS30B♦	349	−80	15-150	−1	−4	30	−3	3	0.2	1★	TO-220AB	RCS29B
RCS32B♦	349	−80	25 min.	−1	−4	40	−5	3	0.2	1★	TO-66	RCS31B
TIP30B	332	−80	15-150	−1	−4	30	−3	3	0.2	1★	TO-220AB	TIP29B
TIP32B	336	−80	25 min.	−1	−4	40	−5	3	0.2	1★	TO-220AB	TIP31B
2N6467	141	−100	5 min.	−4	−4	40	−4	5	–	–	TO-66	2N6465
2N6475	157	−100	2 min.	−2.5	−4	40	−4	10	–	–	TO-220AB	2N6473
BD240C	240	−100	15 min.	−1	−4	30	−4	3	–	–	TO-220AB	BD239C
BD242C	242	−100	10 min.	−3	−4	40	−5	3	–	–	TO-220AB	BD241C

▲Measured at same current level as h_{FE} unless otherwise indicated ○ At I_C = 1A @ t_r ★t_{OFF}

♦Check availability in Europe, the Middle East, and Africa.

Power Transistor Selection Charts

P-N-P SILICON POWER TRANSISTORS (cont'd)

Type No.	DATA-BOOK Page No.	V_{CEO}(sus) V	Current Gain			P_T (Max.) W	I_C (Max.) A	f_T MHz	Sw. Times▲		Package	n-p-n Complement
			h_{FE}	I_C A	V_{CE} V				t_{ON}	t_f		
									µs			
I_C = −2.5 to −5 A, f_T = 2.5 to 25 MHz												
RCA30C ♦	349	−100	15-150	−1	−4	30	−3	3	0.2	1★	TO-220AB	RCA29C
RCA32C ♦	349	−100	25 min.	−1	−4	40	−5	3	0.2	1★	TO-220AB	RCA31C
RCS30C ♦	349	−100	15-150	−1	−4	30	−3	3	0.2	1★	TO-66	RCS29C
RCS32C ♦	349	−100	25 min.	−1	−4	40	−5	3	0.2	1★	TO-66	RCS31C
TIP30C	332	−100	15-150	−1	−4	30	−3	3	0.2	1★	TO-220AB	TIP29C
TIP32C	336	−100	25 min.	−1	−4	40	−5	3	0.2	1★	TO-220AB	TIP32C
2N6468	141	−120	5 min.	−4	−4	40	−4	5	–	–	TO-66	2N6466
2N6476	157	−120	2 min.	−4	−2.5	40	−4	10	–	–	TO-220AB	2N6474
I_C = −6 to −10 A, f_T = 2.5 to 25 MHz												
41501	157	−25	25 min.	−1	−4	40	−7	10	–	–	TO-220AB	41500
2N6110	157	−30	2.3 min.	−7	−4	40	−7	10	–	–	TO-220AA	2N6289
2N6111	157	−30	2.3 min.	−7	−4	40	−7	10	–	–	TO-220AB	2N6288
2N5956	142	−40	5 min.	−6	−4	40	−6	5	–	–	TO-66	2N6374
RCA42 ♦	349	−40	15-150	−3	−4	65	−7	3	0.3●	0.7★●	TO-220AB	RCA41
BD244	244	−45	15 min.	−3	−4	65	−7	3	–	–	TO-220AB	BD243
BD277	246	−45	30-150	−1.75	−2	70	−7	10	–	–	TO-220AB	–
2N6108	157	−50	2.3 min.	−7	−4	40	−7	10	–	–	TO-220AA	2N6291
2N6109	157	−50	2.3 min.	−7	−4	40	−7	10	–	–	TO-220AB	2N6290
2N5955	142	−60	5 min.	−6	−4	40	−6	5	–	–	TO-66	2N6373
BD244A	244	−60	15 min.	−3	−4	65	−7	3	–	–	TO-220AB	BD243A
RCA42A ♦	349	−60	15-150	−3	−4	65	−7	3	0.3●	0.7★●	TO-220AB	RCA41A
2N6106	157	−70	2.3 min.	−7	−4	40	−7	10	–	–	TO-220AA	2N6293
2N6107	157	−70	2.3 min	−7	−4	40	−7	10	–	–	TO-220AB	2N6292
2N5954	142	−80	5 min.	−6	−4	40	−6	5	–	–	TO-66	2N6372
BD244B	244	−80	15 min.	−3	−4	65	−7	3	–	–	TO-220AB	BD243B
RCA42B ♦	349	−80	15-150	−3	−4	65	−7	3	0.3●	0.7★●	TO-220AB	RCA41B
2N6248	174	−100	5 min.	−10	−4	125	−10	10	–	–	TO-3	–
BD244C	244	−100	15 min.	−3	−4	65	−7	3	–	–	TO-220AB	BD243C
RCA42C ♦	349	−100	15-150	−3	−4	65	−7	3	0.3●	0.7★●	TO-220AB	RCA41C
I_C = −12 to −20 A, f_T = 2.5 to 25 MHz												
2N6469	174	−40	5 min.	−15	−4	125	−15	5	–	–	TO-3	2N6470
2N6489	204	−40	5 min.	−15	−4	75	−15	5	–	–	TO-220AB	2N6486
2N6594	73	−40	5-100	−5	−4	100	−12	2.5	1.9■	1.5■	TO-3	2N6594
2N6246	174	−60	5 min.	−15	−4	125	−15	5	–	–	TO-3	2N6471
2N6490	204	−60	5 min.	−15	−4	75	−15	5	–	–	TO-220AB	2N6487
MJ2955	73	−60	20-70	−4	−4	115	−15	2.5	1.9■	1.5■	TO-3	2N3055
2N6247	174	−80	5 min.	−15	−4	125	−15	5	–	–	TO-3	2N6472
2N6491	204	−80	5 min.	−15	−4	75	−15	5	–	–	TO-220AB	2N6488
RCS618	73	−80	20-70	−5	−4	115	−15	2.5	1.9■	1.5■	TO-3	RCS617

N-P-N MONOLITHIC DARLINGTON TRANSISTORS

Type No.	DATA-BOOK Page No.	V_{CEO}(sus) V	Current Gain			P_T (Max.) W	I_C (Max.) A	Package	p-n-p Complement
			h_{FE}	I_C A	V_{CE} V				
I_C(Max.) = 4 A, $f_{UNITY\ GAIN}$ = 20 MHz for all types									
RCS683	328	40	1000 min.	2	3	10	4	TO-39	–
RCS683A	328	60	1000 min.	2	3	10	4	TO-39	–
RCS683B	328	80	1000 min.	2	3	10	4	TO-39	–

▲Measured at same current level as h_{FE} unless otherwise indicated ●At I_C = 6A ★t_{OFF} ■AT I_C = 2A

♦Check availability in Europe, the Middle East, and Africa.

N-P-N MONOLITHIC DARLINGTON TRANSISTORS (cont'd)

Type No.	DATA-BOOK Page No.	V_{CEO}(sus) V	Current Gain			P_T (Max.) W	I_C (Max.) A	Package	p-n-p Complement
			h_{FE}	I_C A	V_{CE} V				
I_C(Max.) = 8 A, $f_{UNITY\ GAIN}$ = 20 MHz for all types									
2N6055	190	60	750-18,000	4	3	100	8	TO-3	–
RCA120♦	194	60	1000 min.	3	3	65	8	TO-220AB	RCA125
TIP120	344	60	1000 min.	3	3	65	8	TO-220AB	TIP125
RCA1000	190	60	1000 min.	3	3	90	8	TO-3	–
2N6056	190	80	750-18,000	4	3	100	8	TO-3	–
2N6530	209	80	1000-10,000	5	3	65	8	TO-220AB	–
2N6534	213	80	1000-10,000	5	3	36	8	TO-66	–
RCA121♦	194	80	1000 min.	3	3	65	8	TO-220AB	RCA126
RCA1001	190	80	1000 min.	3	3	90	8	TO-3	–
TIP121	344	80	1000 min.	3	3	65	8	TO-220AB	TIP126
2N6531	209	100	500-10,000	3	3	65	8	TO-220AB	–
2N6532	209	100	1000-10,000	5	3	65	8	TO-220AB	–
2N6536	213	100	500-10,000	3	3	36	8	TO-66	–
2N6536	213	100	1000-10,000	5	3	36	8	TO-66	–
RCA122♦	194	100	1000 min.	3	3	65	8	TO-220AB	––
TIP122	344	100	1000 min.	3	3	65	8	TO-220AB	TIP127
2N6533	209	120	1000-10,000	3	3	65	8	TO-220AB	–
2N6537	213	120	1000-10,000	3	3	36	8	TO-66	–
I_C(Max.) = 10 A, $f_{UNITY\ GAIN}$ = 20 MHz for all types									
2N6383	190	40	1000-20,000	5	3	100	10	TO-3	RCA8350
2N6386	194	40	1000-10,000	3	3	65	10	TO-220AB	RCA8203
BDX33	249	45	750 min.	4	3	70	10	TO-220AB	BDX34
BDX83	252	45	1000 min.	5	3	125	10	TO-3	–
2N6384	190	60	1000-20,000	5	3	100	10	TO-3	RCA8350A
2N6387	194	60	1000-20,000	5	3	65	10	TO-220AB	RCA8203A
BDX33A	249	60	750 min.	4	3	70	10	TO-220AB	BDX34A
BDX83A	252	60	1000 min.	5	3	125	10	TO-3	–
2N6385	190	80	1000-20,000	5	3	100	10	TO-3	RCA8350B
2N6388	194	80	1000-20,000	5	3	65	10	TO-220AB	RCA8203B
BDX33B	249	80	750 min.	3	3	70	10	TO-220AB	RDX34B
BDX83B	252	80	1000 min.	5	3	125	10	TO-3	–
BDX33C	249	100	750 min.	3	3	70	10	TO-220AB	BDX34C
BDX83C	252	100	1000 min.	5	3	125	10	TO-3	–
BDX33D	249	120	750 min.	3	3	70	10	TO-220AB	–

P-N-P MONOLITHIC DARLINGTON TRANSISTORS

Type No.	DATA-BOOK Page No.	V_{CEO}(sus) V	Current Gain			P_T (Max.) W	I_C (Max.) A	Package	n-p-n Complement
			h_{FE}	I_C A	V_{CE} V				
I_C = –8 A, $f_{UNITY\ GAIN}$ = 20 MHz for all types									
RCA8203	304	–40	1000-20,000	–3	–3	65	–8	TO-220AB	2N6386
TIP125	347	–60	1000 min.	–3	–3	65	–8	TO-220AB	TIP120
RCA125♦	304	–60	1000 min.	–3	–3	65	–8	TO-220AB	RCA120
TIP126	347	–80	1000 min.	–3	–3	65	–8	TO-220AB	TIP121
RCA126♦	304	–80	1000 min.	–3	–3	65	–8	TO-220AB	RCA121
TIP127	347	–100	1000 min.	–3	–3	65	–8	TO-220AB	TIP122
I_C(Max.) = 10 A, $f_{UNITY\ GAIN}$ = 20 MHz for all types									
2N6648	217	–40	1000-20,000	–3	–3	70	–10	TO-204MA	2N6383
RCA8350	308	–40	1000-20,000	–5	–5	70	–10	TO-3	2N6383
BDX34	249	–45	750 min.	–4	–3	70	–10	TO-22AB	BDX33
2N6649	217	–60	1000-20,000	–3	–3	70	–10	TO-204MA	2N6384
BDX34A	249	–60	750 min.	–4	–3	70	–10	TO-220AB	BDX33A
RCA8203A	304	–60	1000-20,000	–5	–3	65	–10	TO-220AB	2N6387
RCA8350A	308	–60	1000-20,000	–5	–3	70	–10	TO-3	2N6384
2N6650	217	–80	1000-20,000	–3	–3	70	–10	TO-204MA	2N6385
BDX34B	249	–80	750 min.	–3	–3	70	–10	TO-220AB	BDX33B
RCA8203B	304	–80	1000-10,000	–5	–3	65	–10	TO-220AB	2N6388
RCA8350B	308	–80	1000-20,000	–5	–3	70	–10	TO-3	2N6385
BDX34C	249	–100	750 min.	–3	–3	70	–10	TO-220AB	BDX33C

♦Check availability in Europe, the Middle East, and Africa.

Power Transistors for Audio-Frequency Applications°

Type No.	Polarity	I_C (A)	P_T (W)	V_{CEO}(sus) (V)	h_{FE}/@ I_C (A)	V_{BE} (V)	V_{CE}(sat) (V)	f_T (MHz)	$I_{S/b}$ (A)	Complementary Type	Package	DATA-BOOK Page No.
RCA1A01	n-p-n	1	5	70	40-200/10 mA	1	1.4	120	–	–	TO-39	280
RCA1A02	p-n-p	−1	7	−50	30-200/-0.1 mA	−0.8	–	60	–	–	TO-39	280
RCA1A05	p-n-p	−1	5	−75*	50-250/-0.15	−1.4	−0.8	60	−0.1	RCA1A06	TO-39	280
RCA1A06	n-p-n	1	5	75*	50-250/0.15	1.4	0.8	120	0.077	RCA1A05	TO-39	280
RCA1A07	n-p-n	1	5	40	50-250/3 mA	1.3	1	120	–	RCA1A08	TO-39	280
RCA1A08	p-n-p	−1	7	−40	70-250/-50 mA	−1.4	−1.4	60	−0.12	RCA1A07	TO-39	280
RCA1A09	n-p-n	1	10	175	20-100/10 mA	0.9	0.5	15	0.065	RCA1A10	TO-39	280
RCA1A10	p-n-p	−1	10	−175	40-250/-10 mA	−0.8	−2	15	−0.04	RCA1A09	TO-39	280
RCA1A11	n-p-n	1	10	175	40-250/1 mA	0.7	–	15	–	–	TO-39	280
RCA1A15	n-p-n	1	10	100	20-100/10 mA	1	1	15	0.2	RCA1A16	TO-39	280
RCA1A16	p-n-p	−1	10	−100	40-250/-10 mA	−1	−1	15	−0.2	RCA1A15	TO-39	280
RCA1A17	n-p-n	1	5	90	40-200/10 mA	1	1.4	120	–	–	TO-39	280
RCA1A18	n-p-n	1	7	10	40-250/10 mA	0.78	1	120	–	RCA1A19	TO-39	280
RCA1A19	p-n-p	−1	7	−10	40-250/-10 mA	−0.78	−1	60	–	RCA1A18	TO-39	280
RCA1A03	n-p-n	2	10	95*	70-300/0.3	1.4	0.8	50	0.2	RCA1A04	TO-39	280
RCA1A04	p-n-p	−2	10	−95*	70-300/-0.3	−1.4	−0.8	50	−0.285	RCA1A03	TO-39	280
RCA1E02	n-p-n	2	35	175	30-150/0.3	1	–	–	0.4	RCA1E03	TO-66	303
RCA1E03	p-n-p	−2	35	−175	30-150/-0.3	−1	–	–	−0.25	RCA1E02	TO-66	303
RCA1C03	n-p-n	4	40	100	50-250/1	1.5	1	4	1	RCA1C04	TO-220AB	292
RCA1C04	p-n-p	−4	40	−100	50-250/-1	−1.5	−1	10	−1	RCA1C03	TO-220AB	292
RCA1C12	n-p-n	4	40	120	40-250/1	1.2	–	4	0.66	RCA1C13	TO-220AB	292
RCA1C13	p-n-p	−4	40	−120	40-250/-1	−1.2	–	10	−0.66	RCA1C12	TO-220AB	292
RCA1C10	n-p-n	7	40	40	50-250/1.5	1.5	1	4	2	RCA1C11	TO-220AB	298
RCA1C11	p-n-p	−7	40	−40	50-250/-1.5	−1.5	−1	10	−2	RCA1C10	TO-220AB	298
RCA1B04	n-p-n	7	150	200	15-75/2	–	2	5	1.25	–	TO-3	285
RCA1B05	n-p-n	7	150	250	15-75/2	1.75	2	5	1.07	–	TO-3	285
RCA1B06	n-p-n	7	150	100	10-50/4	2	2	5	1.87	–	TO-3	291
RCA1B09	n-p-n	7	150	250	40 min./2	1	1	5	1.875	–	TO-3	285
RCA1C05	n-p-n	7	40	50	20-120/3	1.5	1	4	2	RCA1C06	TO-66	293
RCA1C06	p-n-p	−7	40	−50	20-120/-3	−1.5	−1	10	−2	RCA1C05	TO-66	293
RCA1C14	n-p-n	7	50	40	20-70/3	1.4	1	0.8	1.25	–	TO-66	300
RCA1C07	n-p-n	10	75	65	20-120/4	1.5	1	5	2.5	RCA1C08	TO-66	295
RCA1C08	p-n-p	−10	75	−65	20-120/-4	−1.5	−1	5	−2.5	RCA1C07	TO-66	295
RCA1C09	n-p-n	10	75	65	20-120/4	1.5	1	0.8	1.87	–	TO-66	297
RCA1C15	n-p-n	10	65	80	1000-20,000/3	2.8	2	20	2.6	RCA1C16	TO-220AB	301
RCA1C16	p-n-p	−10	65	−80	1000-20,000/−3	−2.8	−2	20	−2.6	RCA1C15	TO-220AB	301
RCA1B01	n-p-n	15	115	95*	20-70/4	1.4	1	0.8	1.95	–	TO-3	284
40311	n-p-n	0.7	5	30	70-350/50 mA	1	–	100	–	–	TO-39	221
40314	n-p-n	0.7	5	40	70-350/50 mA	1	1.4	100	–	40319	TO-39	219
40317	n-p-n	0.7	5	40	40-200/10 mA	1	–	–	–	–	TO-39	219
40319	p-n-p	−0.7	5	−40	35-200/-50 mA	−1	−1.4	100	–	40314	TO-39	219
40362	p-n-p	−0.7	5	−70*	35-200/-50 mA	–	−1.4	100	–	–	TO-39	219
40406	p-n-p	−0.7	1	−50	30-200/-0.1 mA	−0.8	–	100	–	40407	TO-39	224
40407	n-p-n	0.7	1	50	40-200/1 mA	0.8	–	100	–	40406	TO-39	224
40408	n-p-n	0.7	1	90	40-200/10 mA	1	1.4	100	–	–	TO-39	224
40409	n-p-n	0.7	3	90*	50-250/0.15	1	1.4	100	–	40410	TO-39/rad.	224
40410	p-n-p	−0.7	3	−90*	50-250/-0.15	−1	−1.4	100	–	40409	TO-39/rad.	224
40537	p-n-p	−0.7	5	55*	50-300/-50 mA	−1.1	−1.8	100	–	–	TO-39	219
40538	p-n-p	−0.7	5	−55*	15-90/-0.5	−2.7	−2	100	–	40539	TO-39	219
40539	n-p-n	0.7	5	55*	15-90/0.5	2.7	2	100	–	40538	TO-39	219
40321	n-p-n	1	5	300*	25-200/20 mA	2	2	–	–	–	TO-39	219
40327	n-p-n	1	5	300*	40-250/20 mA	2	2	–	–	–	TO-39	219
40412	n-p-n	1	10	250*	40 min./30 mA	–	–	–	0.05	–	TO-39	82
40313	n-p-n	2	35	300*	40-250/0.1	1.5	–	–	0.15	–	TO-66	219
40318	n-p-n	2	35	300*	50 min./0.5	1.5	–	–	0.1	–	TO-66	219
40322	n-p-n	2	35	300*	75 min./0.5	–	–	–	0.1	–	TO-66	219
40310	n-p-n	4	29	35	20-120/1	1.4	–	0.75	–	–	TO-66	219
40312	n-p-n	4	29	60*	20-120/1	1.4	–	0.75	–	–	TO-66	219
40316	n-p-n	4	29	40*	20-120/1	1.4	–	0.75	–	–	TO-66	219
40324	n-p-n	4	29	35	10-120/1	1.4	–	0.75	–	–	TO-66	219
40631	n-p-n	4	36	45*	20-70/2	1.5	1	–	–	–	TO-220AA	226
40325	n-p-n	15	117	35	12-60/8	2	1.5	–	–	–	TO-3	219
40363	n-p-n	15	115	70*	20-70/4	1.8	1.1	0.7	–	–	TO-3	219
40411	n-p-n	30	150	90*	35-100/4	1.2	0.8	100	–	–	TO-3	224

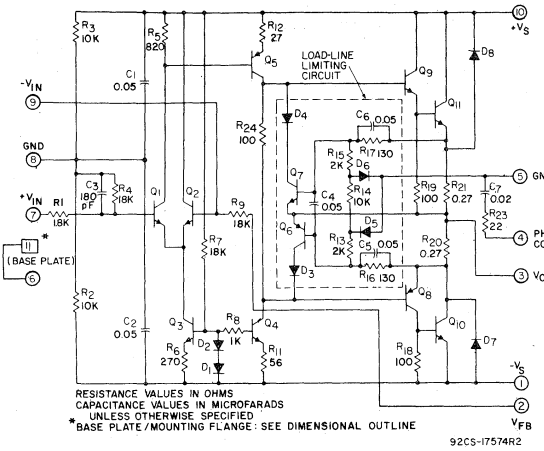
*V_{CER}

° In order of collector-current (I_C) rating

Power Hybrid Comparison Chart

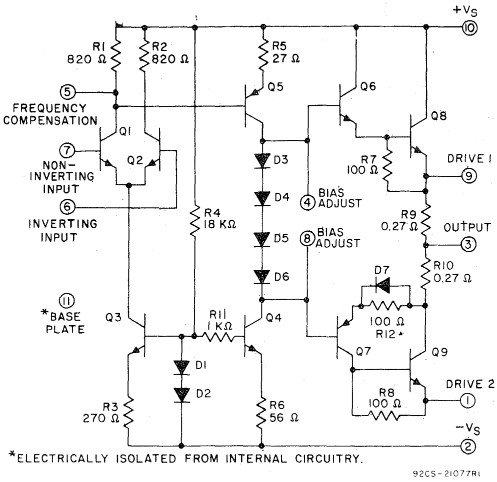
Multi-Purpose High-Power Operational Amplifiers

HC2000H*



Schematic diagram of type HC2000H operational amplifier.

HC2500



Schematic diagram of type HC2500 operational amplifier.

HC2000H* – Applications

Motor control, magnetic-deflection amplifiers, solenoid driver, low-frequency oscillator amplifier, voltage regulators, constant current source, inverting and non-inverting unity-gain amplifier.

HC2500 – Applications

Low-distortion, high-power amplifiers for audio and other end uses where internal overload protection is not required.

Detailed Data for these types are given on pages 393 and 394.

Ratings and Features for HC2000H* and HC2500

Ratings:

SUPPLY VOLTAGE:

Between leads 1 and 10	75 V
OUTPUT CURRENT (peak)	7 A
OPERATING TEMPERATURE RANGE	-55 to +150°C

Features·

Bandwidth: 30 kHz at 60 W

High power output: up to 100 W (rms)

Single or split power supply:
30 to 75 V single, ±15 to ±37.5 V split

COMPARISON CHART

TYPE	IM DIST. @ 200 mW	OUTPUT PROTECTION NETWORK	OPERATING MODE	FREQUENCY COMPENSATION	COMMUTATING DIODES
HC2000H*	0.6%	YES	CLASS B	LC FILTER ON OUTPUT	YES
HC2500	0.06%	NO	CLASS AB	CAPACITOR ON SIGNAL TERMINALS	NO

Socket for both types: RCA part DG-293A, or
Electronic Essentials, 210 Elizabeth St., New York, N.Y. 10012, Part No. MS5-1000

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* *HC2000H also available to MIL-spec as HC2000H/1, 2, 3, 4.*
(see data bulletin file no. 789, or pg. 404 in the "High-Reliability Devices" DATABOOK SSD-230.)

RF Power Transistor Selection Charts

JEDEC (2N) TRANSISTORS

Type	Package Type	Collector-Supply Voltage(V)	Frequency (MHz)	Min. Output Power (W) or Noise Figure (dB)	Data Book Page
2N918	TO-72	6-15(V_{CE})	60	NF = 6	354
2N1491	TO-39	20	70	0.01	355
2N1492	TO-39	30	70	0.1	355
2N1493	TO-39	50	70	0.5	355
2N2631	TO-39	28	50	7.5	356
2N2857	TO-72	6-15(V_{CE})	450	NF = 4.5	357
2N2876	TO-60	28	50	10	356
2N3118	TO-5	28	50	1	358
2N3119	TO-5	28	50	1	359
2N3229	TO-60	50	50	15	360
2N3262	TO-39	(High-speed switching)			361
2N3375	TO-60	28	400	3	362
2N3478	TO-72	6-15(V_{CE})	200	NF = 4.5	364
2N3553	TO-39	28	175	2.5	362
2N3600	TO-72	6-15(V_{CE})	200	NF = 4.5	354
2N3632	TO-60	28	175	13.5	362
2N3733	TO-60	28	400	10	365
2N3839	TO-72	6-15(V_{CE})	450	NF = 3.9	366
2N3866	TO-39	28	400	1	367
2N4012	TO-60	28	1000 (tripler)	2.5	368
2N4427	TO-39	12	175	1	369
2N4440	TO-60	28	400	5	370
2N4932	TO-60	13.5	88	12	371
2N4933	TO-60	24	88	20	371
2N5016	TO-60	28	400	15	372
2N5070	TO-60	28	30	25 (PEP)	373
2N5071	TO-60	24	76	24	374
2N5090	TO-60	28	400	1.2	375
2N5102	TO-60	24	136	15	376
2N5109	TO-39	15	200	NF = 3	377
2N5179	TO-72	6(V_{CE})	200	NF = 4.5	378
2N5180	TO-72	10(V_{CE})	200	NF = 4.5	380
2N5913	TO-39	12	470	2	381
2N6389	TO-72	10	890	NF = 6	382

RCA TRANSISTORS

Type	Package Type	Collector-Supply Voltage(V)	Frequency (MHz)	Min. Output Power (W) or Noise Figure (dB)	Data Book Page
40080	TO-5	12	27	0.1	383
40280	TO-39	13.5	175	1	384
40290	TO-39	12.5	135	2	385
40291	TO-60	12.5	135	2	385
40292	TO-60	12.5	135	6	385
40340	TO-60	13.5	50	25	386
40341	TO-60	24	50	30	386
40446	TO-39+flange	12	27	3	383
40581	TO-39	12	27	3.5	383
40582	TO-39+flange	12	27	3.5	383
40608	TO-39	15	200	NF = 3	387
40894	TO-72	12	200	rf amp.	387
40895	TO-72	12	200	mixer	387
40896	TO-72	12	200	osc.	387
40897	TO-72	12	10.7	if amp.	387
40915	TO-72	10	450	NF = 2.5	389
40936	TO-60	28	30	20 (PEP)	390
40964	TO-39	12	470	0.4	391
40965	TO-39	12	470	0.5	391
41024	TO-39	28	1000	1	392

RF Power Transistor Selection Charts

Types For Microwave Applications

Type	Operating Frequency (GHz)	Min. Output Power (W)	Collector-Supply Voltage (V)	Min. Power Gain (dB)	Collector Efficiency (%)	Package Type
41024	1	1	28	5	35	TO-39

Types For VHF and UHF Mobile-Radio Applications

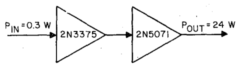
Type	Operating Frequency (MHz)	Min. Output Power (W)	Collector-Supply Voltage (V)	Min. Power Gain (dB)	Package Type
2N4427	175	1	12	10	TO-39
2N5913	175	1.75	12.5	12.4	TO-39
40280	175	1	13.5	9	TO-39
40964	470	0.4	12	6	TO-39
40965	470	0.5	12	7	TO-39

Types For Aircraft-Radio Applications

Type	Operating Frequency (MHz)	Min. Output Power (W)	Collector-Supply Voltage (V)	Min. Power Gain (dB)	Package Type
40290	118-136	2	12.5	6	TO-39
40291	118-136	2	12.5	6	TO-60
40292	118-136	6	12.5	4.8	TO-60
2N5102	118-136	15	24	4	TO-60

Types For Single-Sideband Applications and For Military Communications

Type	Operating Frequency (MHz)	Min. Output Power (W)	Collector-Supply Voltage (V)	Min. Power Gain (dB)	Package Type
40082	30	2.5 (PEP)	12.5	10	TO-39
40936	30	20 (PEP)	28	13	TO-60
2N5070	30	25 (PEP)	28	13	TO-60
2N5071	76	24	24	9	TO-60
2N3866	400	1	28	10	TO-39

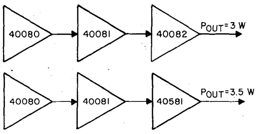


BLOCK DIAGRAM OF A 24-WATT AMPLIFIER FOR 30-76 MHz OPERATION.

92CS-24928

Types For CB-Radio Applications

Type	Frequency (MHz)	Min. Output Power (W)	Collector-Supply Voltage (V)	Package Type
40080	27	0.1	12	TO-5
40081	27	0.4	12	TO-5
40082†	27	3.0	12	TO-39
40581†	27	3.5	12	TO-39
40582	27	3.5	12	TO-39 with flange



BLOCK DIAGRAMS OF 3-WATT AND 3.5-WATT OSCILLATOR/ AMPLIFIER CHAIN FOR CB-RADIO APPLICATIONS.

92CS-24926

†Available with flange

Types For CATV/MATV and Small-Signal Low-Noise Applications

Type	Operating Frequency (MHz)	Noise Figure (dB)	Collector-to-Emitter Voltage (V)	Min. Power Gain (dB)	Package Type
2N918	60	6	6	13	TO-72
2N3478	200	4.5	6-15	11.5	TO-72
2N5179	200	4.5	6	15	TO-72
2N5109	200	3	15	11	TO-39
40608	200	3	15	11	TO-39
40894	200	3	12	15	TO-72
40895	200	–	12	15	TO-72
40896	200	–	12	15	TO-72
2N3600	200	4.5	15	17	TO-72
40897	200	–	12	18	TO-72
40915	450	2.5	10	14	TO-72
2N2857	450	4.5	6	12.5	TO-72
2N3839	450	3.9	6	12.5	TO-72
2N6389	890	6	10	15	TO-72

RCA Radiation-Tolerant Transistors
Typical Data:

Parent Type	Environmental Level A*				
	Test Conditions			P_{OUT} (W)	
	Frequency (MHz)	V_{CC} (V)	P_{IN} (W)	Pre-A	Post-A
2N5071	76	24	3.0	23.6	19.1
2N3375	175	28	0.25	2.2	1.97
2N5016	225	28	5.0	21.8	20.4
	Devices unbiased during radiation				

Data showing effect of radiation at the following environmental levels are available upon request, for a wide range of transistors.

*A. Neutron Fluence: 1.2 x 10^{14} n/cm^2; gamma dose: 1.5 x 10^7 rads.

B. Neutron Fluence: 5.7 x 10^{13} n/cm^2; gamma dose: 1.5 x 10^7 rads.

C. Gamma Dose: 1.5 x 10^7 rads.

Triac Product Matrix

RCA Triacs			Modified TO-5				Mod. TO-5 With Heat Radiator				TO-66		TO-66 With Heat Radiator
STANDARD	$I_{T(RMS)}$		2.5A	2.5A	2.5A	2.5A	2.5A	2.5A	2.5A	2.5A	6A	15A	6A
	I_{TSM} (60 Hz)		25A	25A	25A	25A	25A	25A	25A	25A	100A	100A	100A
	V_{DROM}(V)	50	T2300F	T2301F	T2302F	T2303F	T2310F	T2311F	T2312F	T2313F			
		100	T2300A	T2301A	T2302A	2N5754	T2310A	T2311A	T2312A	T2313A			
		200	T2300B	T2301B	T2302B	2N5755	T2310B	T2311B	T2312B	T2313B	T2700B	T4700B	T2710B
		400	T2300D	T2301D	T2302D	2N5756	T2310D	T2311D	T2312D	T2313D	T2700D	T4700D	T2710D
		450											
		600				2N5757				T2313M			
	I_{GT}(mA)	I+, III−	3	4	10	25	3	4	10	25	25	30	25
		I−, III+	3	4	10	40	3	4	10	40	40	80	40
	V_{GT}(V)	All Modes	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.5	2.2
		Page No.	400	400	400	403	400	400	400	403	410	422	410
ZERO VOLTAGE SWITCH	V_{DROM}(V)	100				T2306A				T2316A			
		200				T2306B				T2316B	T2706B	T4706B	T2716B
		400				T2306D				T2316D	T2706D	T4706D	T2716D
		450											
		600											
	I_{GT}(mA)	I+, III+				45				45	45	45	45
	V_{GT}(V)	I+, III+				1.5				1.5	1.5	1.5	1.5
		Page No.				436				436	436	436	436
400-HZ OPERATION	$I_{T(RMS)}$				0.5A	0.5A							
	V_{DROM}(V)	200			T2304B	T2305B							
		400			T2304D	T2305D							
	I_{GT}(mA)	I+, III−			10	25							
		I−, III+			10	40							
	V_{GT}(V)	All Modes			2.2	2.2							
		Page No.			406	406							

RCA Triacs			TO-220AB VERSAWATT					Press-Fit			Stud		
STANDARD	$I_{T(RMS)}$		6A	6A	8A	8A	ISOWATT* 8A		10A	15A		10A	10A
	I_{TSM} (60 Hz)		60A	80A	100A	100A	100A		100A	100A		100A	100A
	V_{DROM}(V)	100					T2850A						
		200	T2500B	T2801B	T2800B	T2802B	T2850B		2N5567	2N5571		2N5569	2N5573
		300		T2801C	T2800C	T2802C							
		400	T2500D	T2801D	T2800D	T2802D	T2850D		2N5568	2N5572		2N5570	2N5574
		500		T2801E	T2800E	T2802E							
		600			T2800M	T2802M			T4101M	T4100M		T4111M	T4110M
	I_{GT}(mA)	I+, III−	25	80	25	50	25		25	50		25	50
		I−, III+	60	–	60	–	60		40	80		40	80
	V_{GT}(V)	All Modes	2.5	4.0▲	2.5	2.5▲	2.5		2.5	2.5		2.5	2.5
		Page No.	408	412	412	412	412		415	415		415	415
ZERO VOLTAGE SWITCH	V_{DROM}(V)	100											
		200	T2506B			T2806B	T2856B		T4107B	T4106B		T4117B	T4116B
		400	T2506D			T2806D	T2856D		T4107D	T4106D		T4117D	T4116D
		450											
		600							T4107M	T4106M		T4117M	T4116M
	I_{GT}(mA)	I+, III+	45			45	45		45	45		45	45
	V_{GT}(V)	I+, III+	1.5			1.5	1.5		1.5	1.5		1.5	1.5
		Page No.	436			436	436		436	436		436	436
400-HZ OPERATION	$I_{T(RMS)}$							6A	10A	15A	6A	10A	15A
	V_{DROM}(V)												
		200						T4105B	T4104B	T4103B	T4115B	T4114B	T4113B
		400						T4105D	T4104D	T4103D	T4115D	T4114D	T4113D
	I_{GT}(mA)	I+, III−						50	50	50	50	50	50
		I−, III+						80	80	80	80	80	80
	V_{GT}(V)	All Modes						2.5	2.5	2.5	2.5	2.5	2.5
		Page No.						419	419	419	419	419	419

* ISOWATT – Mounting tab electrically isolated from electrodes

▲ I+, III− only

Triac Product Matrix

RCA Triacs			Isolated Stud		Press-Fit						TO-220AB VERSAWATT			Press-Fit		Stud		
					With flex. leads, encap. on isolated-stud		Isolated on TO-3 flange		With flex. leads, encap., isolated on TO-3 flange									
STANDARD	$I_{T(RMS)}$		10A	15A	10A	15A	10A	15A	10A	15A	16A	16A	16A	30A	40A	30A		40A
	I_{TSM}(60 Hz)		100A	100A	100A	100A	100A	100A	100A	100A	150A	150A	150A	300A	300A	300A		300A
	V_{DROM}(V)	100																
		200	T4121B	T4120B	T4131B	T4130B	T4141B	T4140B	T4151B	T4150B	T6000B	T6001B	T6006B	T6401B	2N5441	T6411B		2N5444
		300									T6000C	T6001C	T6006C					
		400	T4121D	T4120D	T4131D	T4130D	T4141D	T4140D	T4151D	T4150D	T6000D	T6001D	T6006D	T6401D	2N5442	T6411D		2N5445
		450																
		500									T6000E	T6001E	T6006E					
		600	T4121M	T4120M	T4131M	T4130M	T4141M	T4140M	T4151M	T4150M	T6000M	T6001M	T6006M	T6401M	2N5443	T6411M		2N5446
	I_{GT}(mA)																	
		I+, III−	25	50	25	50	25	50	25	50	50	80	45▲	50	50	50		50
		I−, III+	40	80	40	80	40	80	40	80	80	–	45▲	80	80	80		80
	V_{GT}(V)																	
		All Modes	415	415	421	421	421	421	421	421	424	424	424	427	427	427		427
		Page No.																
ZERO VOLTAGE SWITCH	V_{DROM}(V)																	
		100																
		200	T4127B	T4126B										T6407B	T6406B*	T6417B		T6416B
		400	T4127D	T4126D										T6407D	T6406D	T6417D		T6416D
		450																
		600	T4127M	T4126M										T6407M	T6406M	T6417M		T6416M
	I_{GT}(mA)																	
		I+, III+												45	45	45		45
	V_{GT}(V)																	
		I+, III+												1.5	1.5	1.5		1.5
		Page No.	436	436										436	436	436		436
400-HZ OPERATION	$I_{T(RMS)}$													25A	25A	25A	25A	40A
	V_{DROM}(V)	200												T6405B	T6404B	T6415B	2N5806	T6414B
		400												T6405D	T6404D	T6415D	2N5807	T6414D
		500															2N5808	
		600															2N5809	
	I_{GT}(mA)																	
		I+, III−												80	80	80	80	80
		I−, III+												120	120	120	150•	120
	V_{GT}(V)																	
		All Modes												3	3	3	2.5▼	3
		Page No.												431	431	431	427	431

• 80 A for I− mode.

▼4 V for III+ mode.

*1+, 111− modes only

▲1+, 111+ modes only

RCA Triacs			Isolated Stud		Press-Fit						Overmold Stud		Overmold Isolated Stud	
					With flex. leads, encap. on isolated-stud		Isolated on TO-3 flange		With flex. leads, encap., isolated on TO-3 flange					
STANDARD	$I_{T(RMS)}$		30A	40A	30A	40A	30A	40A	30A	40A	60A	80A	60A	80A
	I_{TSM} (60 Hz)		300A	300A	300A	300A	300A	300A	300A	300A	600A	850A	600A	850A
	V_{DROM}(V)	100												
		200	T6421B	T6420B	T6431B	T6430B	T6441B	T6440B	T6451B	T6450B	T8411B	T8410B	T8421B	T8420B
		400	T6421D	T6420D	T6431D	T6430D	T6441D	T6440D	T6451D	T6450D	T8411D	T8410D	T8421D	T8420D
		450												
		600	T6421M	T6420M	T6431M	T6430M	T6441M	T6440M	T6451M	T6450M	T8411M	T8410M	T8421M	T8420M
	I_{GT}(mA)													
		I+, III−	50	50	50	50	50	50	50	50	75	75	75	75
		I−, III+	80	80	80	80	80	80	80	80	150	150	150	15
	V_{GT}(V)													
		All Modes	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.8	2.5	2.8	2.5
		Page No.	427	427	421	421	421	421	421	421	433	433	433	433
ZERO VOLTAGE SWITCH	V_{DROM}(V)	100												
		200	T6427B	T6426B										
		400	T6427D	T6426D										
		450												
		600	T427M	T6426M										
	I_{GT}(mA)													
		I+, III+	45	45										
	V_{GT}(V)													
		I+, III+	1.5	1.5										
		Page No.	436	436										

SCR Product Matrix

RCA SCR's		TO-8	TO-202AB VERSATAB						TO-66				
$I_{T(RMS)}$		2A	4A	4A	4A	4A	4A	4A	5A	FTO* 5A	FTO* 5A	FTO* 5A	FTO* 5A
I_{TSM} (60 Hz)		60A	20A	15A	30A	20A	20A	20A	60A	80A	80A	80A	75A(I_{PM})
V_{DROM}	15		C106Q	C107Q	C108Q	S106Q	S107Q	S108Q					
V_{RROM}(V)	25												
	30		C106Y	C107Y	C108Y	S106Y	S107Y	S108Y					
	50		C106F	C107F	C108F	S106F	S107F	S108F					
	100		C106A	C107A	C108A	S106A	S107A	S108A				S3704A	
	150												
	200	2N3528	C106B	C107B	C108B	S106B	S107B	S108B	2N3228		S3700B	S3704B	
	250												
	300												
	400	2N3529	C106D	C107D	C108D	S106D	S107D	S108D	2N3525		S3700D	S3704D	
	500		C106E	C107E	C108E	S106E	S107E	S108E		S3706E			
	600	2N4102	C106M	C107M	C108M	S106M	S107M	S108M	2N4101	S3705M	S3700M	S3704M	S3701M
	700											S3704S	
	750												
I_{GT}(mA)		15	0.2	0.5	0.2	0.2	0.5	2	15	30	40	40	35
V_{GT}(V)		2	0.8	0.8	0.8	0.8	0.8	0.8	2	4	3.5	3.5	4
Page No.		447	438	438	438	438	438	438	447	459	456	456	458

*FTO – Fast Turn-Off

RCA SCR's		TO-66		TO-66 With Heat Rad.		Low Profile Mod. TO-5	TO-5 With Heat Rad.	TO-5 With Heat Spreader	TO-220 AB VERSAWATT				
I_T(RMS)		FTO* 5A	FTO* 5A	5A	FTO* 5A	7A	3.3A	7A	4A	4A	4A	8A	10A
I_{TSM}(60 Hz)		80A	80A	80A	80A	100A	100A	100A	35A	35A	35A	100A	100A
V_{DROM}	15								S2060Q	S2061Q	S2062Q		
V_{RROM}(V)	25												
	30								S2060Y	S2061Y	S2062Y		
	50								S2060F	S2061F	S2062F	S122F	S2800F
	100				S3714A				S2060A	S2061A	S2062A	S122A	S2800A
	150												
	200			S2710B	S3714B	S2600B	S2610B	S2620B	S2060B	S2061B	S2062B	S122B	S2800B
	250												
	300								S2060C	S2061C	S2062C	S122C	S2800C
	400			S2710D	S3714D	S2600D	S2610D	S2620D	S2060D	S2061D	S2062D	S122D	S2800D
	500								S2060E	S2061E	S2062E	S122E	S2800E
	600			S2710M	S3714M	S2600M	S2610M	S2620M	S2060M	S2061M	S2062M	S122M	S2800M
	700	S3702S			S3714S							S122S	S2800S
	750		S3703SF										
I_{GT}(mA)		45	40	15	40	15	15	15	0.2	0.5	2	25	15
V_{GT}(V)		4	4	2	3.5	1.5	1.5	1.5	0.8	0.8	0.8	1.5	1.5
Page No.		459	459	447	456	450	450	450	444	444	444	453	453

*FTO – Fast Turn-Off

RCA SCR's		TO-220AB VERSAWATT		Stud	TO-3	Press-Fit		Stud		Isolated Stud	
I_T(RMS)		12	16	FTO*♦ 10A	12.5	20A	35A	20A	35A	20A	35A
I_{TSM} (60 Hz)		125	160	90A	200A	200A	350A	200A	350A	200A	350A
V_{DROM}	15										
V_{RROM}(V)	25										
	30										
	50	2N6394	2N6400								
	100	2N6395	2N6401		2N3668	S6200A	2N3870	S6210A	2N3896	S6220A	S6420A
	150										
	200	2N6396	2N6402	S5210B	2N3669	S6200B	2N3871	S6210B	2N3897	S6220B	S6420B
	250										
	300	S6000C	S6100C								
	400	2N6397	2N6403	S5210D	2N3670	S6200D	2N3872	S6210D	2N3898	S6220D	S6420D
	500	S6000E	S6100E								
	600	2N6398	2N6404	S5210M	2N4103	S6200M	2N3873	S6210M	2N3899	S6220M	S6420M
	700	S6000S	S6100S								
	750										
	800										
I_{GT}(mA)		30	30	40	40	15	40	15	40	15	40
V_{GT}(V)		1.5	1.5	3.5	2	2	2	2	2	2	2
Page No.		470	470	468	465	473	477	473	477	473	477

* FTO-Fast Turn-Off.

♦Check availability in Europe, the Middle East, and Africa.

SCR Product Matrix

RCA SCR's		Press-Fit					
		With flex. leads, encap. on isolated -stud		Isolated on TO-3 flange		With flex. leads, encap., isolated on TO-3 flange	
I_T(RMS)		20A	35A	20A	35A	20A	35A
I_{TSM} (60 Hz)		200A	350A	200A	350A	200A	350A
V_{DROM}	15						
V_{RROM}(V)	25						
	30						
	50						
	100	S6230A	S6430A	S6240A	S6440A	S6250A	S6450A
	150						
	200	S6230B	S6430B	S6240B	S6440B	S6250B	S6450B
	250						
	300						
	400	S6230D	S6430D	S6240D	S6440D	S6250D	S6450D
	500						
	600	S6230M	S6430M	S6240M	S6440M	S6250M	S6450M
	700						
	750						
	800						
I_{GT}(mA)		15	40	15	40	15	40
V_{GT}(V)		2	2	2	2	2	2
	Page No.	476	476	476	476	476	476

RCA SCR's		TO-48				
I_T(RMS)		16A	25A	Pulse Modulator 35A	FTO* 35A	FTO* 35A
I_{TSM} (60 Hz)		125A	150A	150A	180A	180A
V_{DROM}	15					
V_{RROM}(V)	25	2N1842A	2N681			
	30					
	50	2N1843A	2N682			2N3654
	100	2N1844A	2N683		2N3650	2N3655
	150	2N1845A	2N684			
	200	2N1846A	2N685		2N3651	2N3656
	250	2N1847A	2N686			
	300	2N1848A	2N687		2N3652	2N3657
	400	2N1849A	2N688		2N3653	2N3658
	500	2N1850A	2N689			
	600		2N690	S6493M	S7410M	S7412M
	700					
	750					
	800					
I_{GT}(mA)		45	25	80	180	180
V_{GT}(V)		3.5	3	2	3	2
	Page No.	480	480	483	483	483

*FTO — Fast Turn-Off

ITR Product Matrix

For Horizontal-Deflection Circuits

RCA ITR's*		TO-220AB VERSAWATT			
		Trace	Commutating (Retrace)	Trace	Commutating (Retrace)
I_T(RMS)		8A	8A	8A	8A
I_{TSM} (60 Hz)		90A	90A	90A	90A
V_{DROM}(V)	300				
	400				
	450			S3902DF	
	500				
	550				
	600		S3901M		
	650	S3900MF	S3901MF		S3903MF
	700	S3900S	S3901S		
	750	S3900SF			
I_{GT}(mA)		30	45		
V_{GT}(V)		4	4		
	Page No.	462	462	462	462

*Integrated Thyristor/Rectifiers

GTO Product Matrix

RCA GTO's*		TO-3		
I_T(DC)		8.5A	8.5A	8.5A
I_{TSM} (60 Hz)		50A	50A	50A
V_{DRXM}(V)	100	G5001A	G5002A	G5003A
	200	G5001B	G5002B	G5003B
	400	G5001D	G5002D	G5003D
	600	G5001M	G5002M	G5003M
Turn-on Time	t_d	1μs	1.5μs	1.5μs
tgt	t_r	1μs	1.5μs	1.5μs
Turn-off Time	t_s	1μs	3μs	10μs
t_q	t_f	1μs	3μs	10μs
	Page No.	491	491	491

*Gate-turn-off SCR's

Diac Product Matrix

For Triggering Triacs

RCA Diacs	DO-15	
	D3202Y	D3202U
I_{pk}	2A	2A
$\pm V_{(BO)}$	29 min. 35 max. V	25 min. 40 max. V
$\lvert +V_{(BO)}\rvert - \lvert -V_{(BO)}\rvert$	±3 max. V	±3 max. V
$\lvert \Delta V\pm \rvert$	9 min. V	9 min. V
Page No.	495	495

Rectifier Product Matrix

Standard Types

RCA Rectifiers		Modified TO-1 (2-lead)	DO-1				DO-26				DO-15	
I_O		0.25A	0.75A ◆	0.75A ◆	1A ◆	1A	0.75A ◆	0.75A ◆ Insulated	1A	1A Insulated	1A	1.5A
I_{FSM}		30A	15A	15A	35A	35A	35A	35A	50A	50A	30A	50A
$V_{RRM}(V)$	50			1N536		1N2858A					D1201F	1N5391
	100	D1300A	1N440B	1N537		1N2859A					D1201A	1N5392
	200	D1300B	1N441B	1N538		1N2860A	1N3193	1N3253	1N5211	1N5215	D1201B	1N5393
	300		1N442B	1N539		1N2861A						1N5394
	400	D1300D	1N443B	1N540	1N1763A	1N2862A	1N3194	1N3254	1N5212	1N5216	D1201D	1N5395
	500		1N444B	1N1095	1N1764A	1N2863A						1N5396
	600		1N445B	1N547		1N2864A	1N3195	1N3255	1N5213	1N5217	D1201M	1N5397
	800						1N3196	1N3256	1N5214	1N5218	D1201N	1N5398
	1000							1N3563			D1201P	1N5399
	Page No.	497	497	497	497	497	497	498	498	498	497	497

Standard Type (cont'd)

RCA Rectifiers		DO-4		DO-5	
I_O		6A	12A	20A	40A
I_{FSM}		160A	240A	350A	800A
$V_{RRM}(V)$	50	1N1341B	1N1199A	1N248C	1N1183A
	100	1N1342B	1N1200A	1N249C	1N1184A
	200	1N1344B	1N1202A	1N250C	1N1186A
	300	1N1345B	1N1203A	1N1195A	1N1187A
	400	1N1346B	1N1204A	1N1196A	1N1188A
	500	1N1347B	1N1205A	1N1197A	1N1189A
	600	1N1348B	1N1206A	1N1198A	1N1190A
	800				
	1000				
	Page No.	498	498	498	498

Types For Horizontal-Deflection Circuits

RCA Rectifiers	DO-26			DO-1		DO-15
I_O	0.5* ◆	1.6* ◆	1.9*	–	–	1A
I_{FSM}	30A	70A	70A	70A	30A	50A
Trace			D2601M	D2103SF		D2201M
Commutating		D2601E		D2103S		D2201M
Linearity						D2201B
Regulator						D2201B
Clamp	D2600M				D2101S	
Page No.	500	500	500	500	500	500

*$I_{F(RMS)}$ value

Fast-Recovery Types

RCA Rectifier		DO-26	DO-15	DO-4				DO-5			
I_O		1A	1A	6A	6A ◆	12A	12A ◆	20A	20A ◆	30A	40A
I_{FSM}		35A	50A	75A	125A	150A	250A	225A	300A	300A	700A
$V_{RRM}(V)$	50	D2601F	D2201F	1N3879	D2406F	1N3889	D2412F	1N3899	D2520F	1N3909	D2540F
	100	D2601A	D2201A	1N3880	D2406A	1N3890	D2412A	1N3900	D2520A	1N3910	D2540A
	200	D2601B	D2201B	1N3881	D2406B	1N3891	D2412B	1N3901	D2520B	1N3911	D2540B
	300			1N3882	D2406C	1N3892	D2412C	1N3902	D2520C	1N3912	
	400	D2601D	D2201D	1N3883	D2406D	1N3893	D2412D	1N3903	D2520D	1N3913	D2540D
	500										
	600	D2601M	D2201M		D2406M		D2412M		D2520M		D2540M
	800	D2601N	D2201N								
	1000										
Reverse Recovery Time t_{rr}											
	Typ.	200 ns.	200 ns.	–	200 ns.	–	200 ns.	–	200 ns.	–	200 ns.
	Max.	500 ns.	500 ns.	200 ns.	350 ns.	200 ns.	350 ns.	200 ns.	350 ns.	200 ns.	350 ns.
	Page No.	500	500	500	500	500	500	501	501	501	501

◆Check availability in Europe, the Middle East, and Africa.

Thyristor and Rectifier Type-Number Systems

In January 1974, a system of coded type numbers was adopted for all non-JEDEC RCA triacs, silicon controlled rectifiers (SCR's), rectifiers, and diacs. The type number for JEDEC devices, i.e., devices registered with the Joint Electron Devices Engineering Council of the Electronic Industries Association (EIA), consists of the prefix "1N" (for diodes) or "2N" (for thyristors) followed by a number. EIA assigns these type numbers sequentially, and they provide no information on device features and capabilities.

The type numbers for non-JEDEC RCA thyristors, rectifiers, and diacs consist of an alpha-numeric code that immediately identifies the basic type of device and provides information on significant device features. The basic product type is indicated by the initial letter in the type-number designation, i.e., T = triacs, S = SCR or ITR, G = gate-turn-off SCR (GTO), and D = rectifier or diac. The numbers following the initial letter indicate device current ratings, type of package, and electrical variants within a series. The suffix letter(s) define the voltage rating of the device.

Sixteen suffix letters are used to represent specific voltage ratings in the range from 15 to 1000 volts. Combinations of these letters can be used to indicate voltage ratings that differ from the sixteen basic values. (For example, the suffix DF is used for a voltage rating of 450 volts; i.e., D + F = 400 + 50 = 450 volts.)

The charts shown below provide a detailed explanation of the new type number codes. For the convenience of the user who has RCA thyristors and rectifiers obtained prior to January 1974, a cross reference of old-to-new type numbers is shown on the following page.

Graphic Representation of Rectifier and Diac Numbering System

Indicates Rectifier or Diac

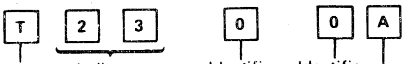
Indicates Type
1 = Standard
2 = Fast Recovery
3 = Diac

Indicates Package
1 = DO-1
2 = DO-15
3 = TO-1
4 = DO-4
5 = DO-5
6 = DO-26
7 = DO-26 Insulated

Indicates Average Current Rating I_O (00 indicates $I_O < 1$ A)

Voltage Designation
Q = 15 V
U = 25 V
Y = 30 V
F = 50 V
A = 100 V
G = 150 V
B = 200 V
H = 250 V
C = 300 V
D = 400 V
E = 500 V
M = 600 V
S = 700 V
N = 800 V
T = 900 V
P = 1000 V

Graphic Representation of Thyristor Numbering System



Indicates Type
T = Triac
S = SCR
G = GTO

Indicates Broad Generic Classification on basis of $I_{T(RMS)}$ Rating

$I_{T(RMS)}$ Ratings (A)	Standard Devices	Fast-Turnoff Devices
0 - 2.5	00 - 09	10 - 19
2.5 - 10	20 - 29	30 - 39
10 - 15	40 - 49	50 - 59
15 - 40	60 - 69	70 - 79
> 40	80 - 89	90 - 99

Identifies Package Variants

Identifies Electrical Variants

Voltage Designation (as shown at left)

(NOTE: The first five digits, e.g., T2300, provide the basic device series designation.)

Thyristor and Rectifier Type-Number Systems

Old Number-to-New Number Cross Reference

Former RCA Type No.	New RCA Type No.	Former RCA Type No.	New RCA Type No.	Former RCA Type No.	New RCA Type No.	Former RCA Type No.	New RCA Type No.
RCA 106A	S2060A	40663	T6411D	40756	S6210M	40925	T6400N
RCA 106B	S2060B	40668	T2800B	40757	S6220A	40926	T6410N
RCA 106C	S2060C	40669	T2800D	40758	S6220B	40927	T6420N
RCA 106D	S2060D	40670	T2800M	40759	S6220D	40937	S6400N
RCA 106E	S2060E	40671	T6401M	40760	S6220M	40938	S6410N
RCA 106F	S2060F	40672	T6411M	40761	T2311B	40942	S2400A
RCA 106Q	S2060Q	40680	S6420A	40762	T2311D	40943	S2400B
RCA106M	S2060M	40681	S6420B	40766	T2301A	40944	S2400D
RCA 106Y	S2060Y	40682	S6420D	40767	T2311A	40945	S2400M
RCA 107A	S2061A	40683	S6420M	40768	S2701M	40952	S6420N
RCA 107B	S2061B	40684	T2313A	40769	T2304B	40956	D2540F
RCA 107C	S2061C	40685	T2313B	40770	T2304D	40957	D2540A
RCA 107D	S2061D	40686	T2313D	40771	T2305B	40958	D2540B
RCA 107E	S2061E	40687	T2313M	40772	T2305D	40959	D2540D
RCA 107F	S2061F	40688	T6420B	40775	T4105B	40960	D2540M
RCA 107Q	S2061Q	40689	T6420D	40776	T4105D	41014	T2500B
RCA 107M	S2061M	40690	T6420M	40777	T4115B	41015	T2500D
RCA 107Y	S2061Y	40691	T2301B	40778	T4115D	41017	S3800SF
RCA 108A	S2062A	40692	T2301D	40779	T4104B	41018	S3800MF
RCA 108B	S2062B	40693	T2316A	40780	T4104D	41019	S3800E
RCA 108C	S2062C	40694	T2316B	40781	T4114B	41020	S3800S
RCA 108D	S2062D	40695	T2316D	40782	T4114D	41021	S3800M
RCA 108E	S2062E	40696	T2306A	40783	T4103B	41022	S3800EF
RCA 108F	S2062F	40697	T2306B	40784	T4103D	41023	S3800D
RCA 108Q	S2062Q	40698	T2306D	40785	T4113B	43879	D2406F
RCA 108M	S2062M	40699	T6406B	40786	T4113D	43880	D2406A
RCA 108Y	S2062Y	40700	T6406D	40787	T6405B	43881	D2406B
40216	S6493M	40701	T6406M	40788	T6405D	43882	D2406C
40429	T2700B	40702	T6416B	40789	T6415B	43883	D2406D
40430	T2700D	40703	T6416D	40790	T6415D	43884	D2406M
40502	T2710B	40704	T6416M	40791	T6404B	43889	D2412F
40503	T2710D	40705	T6407M	40792	T6404D	43890	D2412A
40504	S2710B	40706	T6407D	40793	T6414B	43891	D2412B
40505	S2710D	40707	T6417B	40794	T6414D	43892	D2412C
40506	S2710M	40708	T6417D	40795	T4101M	43893	D2412D
40525	T2300A	40709	T6407M	40796	T4111M	43894	D2412M
40526	T2300B	40710	T6417M	40797	T4100M	43899	D2520F
40527	T2300D	40711	T4106B	40798	T4110M	43900	D2520A
40528	T2302A	40712	T4106D	40799	T4121B	43901	D2520B
40529	T2302B	40713	T4116B	40800	T4121D	43902	D2520C
40530	T2302D	40714	T4116D	40801	T4121M	43903	D2520D
40531	T2310A	40715	T4706B	40802	T4120B	43904	D2520M
40532	T2310B	40716	T4706D	40803	T4120D	44001	D1201F
40533	T2310D	40717	T4107B	40804	T4120M	44002	D1201A
40534	T2312A	40718	T4107D	40805	T6421B	44003	D1201B
40535	T2312B	40719	T4117B	40806	T6421D	44004	D1201D
40536	T2312D	40720	T4117D	40807	T6421M	44005	D1201M
40553	S3700B	40721	T2806B	40833	S2600M	44006	D1201N
40554	S3700D	40722	T2806D	40834	S2620M	44007	D1201P
40555	S3700M	40727	T2706B	40835	S2610M	44933	D2201F
40575	T4700B	40728	T2706D	40867	S2800A	44934	D2201A
40576	T4700D	40729	T2716B	40868	S2800B	44935	D2201B
40654	S2600B	40730	T2716D	40869	S2800D	44936	D2201D
40655	S2600D	40735	S7410M	40888	S3703SF	44937	D2201M
40656	S2620B	40749	S6200A	40889	S3702S	44938	D2201N
40657	S2620D	40750	S6200B	40890	D2103SF	45411	D3202Y
40658	S2610B	40751	S6200D	40891	D2103S	45412	D3202U
40659	S2610D	40752	S6200M	40892	D2101S	TA7892	D2601B
40660	T6401B	40753	S6210A	40900	T2850A	TA7893	D2601D
40661	T6401D	40754	S6210B	40901	T2850B	TA7894	D2601M
40662	T6411B	40755	S6210D	40902	T2850D	TA7895	D2601N

Power Devices Cross-Reference Guide

(Industry Type to Equivalent RCA Type)

This guide provides a quick reference to more than 2000 industry power devices (power transistors, silicon controlled rectifiers, and triacs) and their nearest RCA replacements. The nearest RCA device is determined on the basis of electrical similarity as well as package similarity.

POWER TRANSISTORS

Industry Type	Package	RCA Type	Package
2N656	TO-5	2N2102	TO-39
2N1132	TO-5	2N4037	TO-39
2N1132A	TO-5	2N4037	TO-39
2N1420	TO-5	2N1711	TO-39
2N1507	TO-5	2N1711	TO-39
2N1565	TO-5	40360	TO-39
2N1565A	TO-5	40360	TO-39
2N1573	TO-5	40409	TO-39HR
2N1574	TO-5	40409	TO-39HR
2N1613S	TO-5	2N1613	TO-39
2N1711S	TO-5	2N1711	TO-39
2N1714	TO-5	2N1480	TO-39
2N1889	TO-5	2N699	TO-39
2N1893S	TO-5	2N1893	TO-39
2N1974	TO-5	40360	TO-39
2N1975	TO-5	40360	TO-39
2N1984	TO-5	40360	TO-39
2N1985	TO-5	40360	TO-39
2N1986	TO-5	2N3053	TO-39
2N1987	TO-5	2N697	TO-39
2N1990	TO-5	BF257	TO-39
2N1990S	TO-5	BF257	TO-39
2N2034	TO-5	2N5784	TO-39
2N2049	TO-5	2N1711	TO-39
2N2102S	TO-5	2N2102	TO-39
2N2192	TO-5	2N1711	TO-39
2N2193	TO-39	2N1613	TO-39
2N2194	TO-39	2N699	TO-39
2N2195	TO-39	2N697	TO-39
2N2195A	TO-39	2N697	TO-39
2N2217	TO-39	2N697	TO-39
2N2218	TO-39	2N697	TO-39
2N2243	TO-39	2N1893	TO-39
2N2243A	TO-39	2N1893	TO-39
2N2270S	TO-39	2N2270	TO-39
2N2297	TO-39	2N1613	TO-39
2N2297S	TO-39	2N1613	TO-39
2N2303	TO-39	40315	TO-39
2N2330	TO-39	40814	TO-39
2N2410	TO-39	2N3053	TO-39
2N2537	TO-39	40635	TO-39
2N2538	TO-39	2N1711	TO-39
2N2800	TO-39	40406	TO-39
2N2801	TO-39	40815	TO-39
2N2846	TO-39	2N697	TO-39
2N2848	TO-39	2N697	TO-39
2N2863	TO-39	2N5321	TO-39
2N2864	TO-39	2N3053	TO-39
2N2868	TO-39	2N3053	TO-39
2N2951	TO-39	41502	TO-39
2N2958	TO-39	2N697	TO-39
2N2959	TO-39	2N1711	TO-39
2N3020	TO-39	2N1893	TO-39
2N3036	TO-5	2N5320	TO-39
2N3108	TO-39	2N2102	TO-39
2N3109	TO-39	2N1711	TO-39
2N3110	TO-39	2N3053	TO-39
2N3114	TO-39	BF257	TO-39
2N3122	TO-5	2N5321	TO-39
2N3133	TO-39	40634	TO-39
2N3134	TO-39	2N4037	TO-39
2N3171	TO-3	2N6254	TO-3
2N3172	TO-3	2N6246	TO-3
2N3173	TO-3	2N6247	TO-3
2N3174	TO-3	2N6248	TO-3
2N3183	TO-3	2N6246	TO-3
2N3184	TO-3	2N6246	TO-3
2N3185	TO-3	2N6247	TO-3
2N3186	TO-3	2N6248	TO-3
2N3195	TO-3	2N6246	TO-3
2N3196	TO-3	2N6246	TO-3
2N3197	TO-3	2N6247	TO-3
2N3198	TO-3	2N6248	TO-3
2N3202	TO-5	2N5783	TO-39
2N3203	TO-5	2N5781	TO-39
2N3208	TO-5	2N5783	TO-39
2N3224	TO-5	2N5415	TO-39
2N3225	TO-5	2N5415	TO-39
2N3226	TO-3	2N6253	TO-3
2N3233	TO-3	2N3442	TO-3
2N3234	TO-3	2N3055	TO-3
		2N6262	TO-3
2N3235	TO-3	2N3055	TO-3
2N3236	TO-3	2N6254	TO-3
2N3237	TO-3	2N6258	TO-3
2N3238	TO-3	2N6258	TO-3
2N3239	TO-3	2N6258	TO-3
2N3240	TO-3	2N6259	TO-3
2N3244	TO-39	2N5323	TO-39
2N3245	TO-39	2N5323	TO-39
2N3292	TO-5	2N697	TO-39
2N3300	TO-5	2N1711	TO-39
2N3418	TO-39	2N5320	TO-39
2N3444	TO-39	2N5321	TO-39
2N3445	TO-3	2N6471	TO-3
2N3446	TO-3	2N6472	TO-3
2N3447	TO-3	2N6471	TO-3
2N3448	TO-3	2N6472	TO-3
2N3464	TO-39	2N3053	TO-39
2N3597	TO-63	2N3266	TO-63
2N3598	TO-63	2N3266	TO-63
2N3599	TO-63	2N3265	TO-63
2N3665	TO-39	2N1893	TO-39
2N3672	TO-5	2N699	TO-39
2N3712	TO-39	2N3440	TO-39
		BF257	TO-39
2N3713	TO-3	2N3055	TO-3
		2N6471	TO-3
2N3714	TO-3	2N6254	TO-3
		2N6472	TO-3
2N3715	TO-3	2N3055	TO-3
		2N6471	TO-3
2N3716	TO-3	2N6254	TO-3
		2N6472	TO-3
2N3719	TO-39	2N5323	TO-39
2N3720	TO-39	2N5322	TO-39
2N3738	TO-66	2N3584	TO-66
2N3739	TO-66	2N3585	TO-66
2N3740	TO-66	2N5955	TO-66
2N3741	TO-66	2N5954	TO-66
2N3742	TO-39	2N3439	TO-39
		BF259	TO-39
2N3743	TO-39	2N5416	TO-39
		BFT19B	TO-39
2N3766	TO-66	2N3879	TO-66
		2N6373	TO-66
2N3767	TO-66	2N6372	TO-66
2N3774	TO-5	2N5783	TO-39
2N3775	TO-5	2N5781	TO-39
2N3778	TO-5	2N5783	TO-39
2N3779	TO-5	2N5781	TO-39
2N3782	TO-5	2N5783	TO-39
2N3788	TO-3	2N5840	TO-3
2N3789	TO-3	2N6246	TO-3
2N3790	TO-3	2N6247	TO-3

Power Devices Cross-Reference Guide
(Industry Type to Equivalent RCA Type)

POWER TRANSISTORS (CONT'D)

Industry Type	Package	RCA Type	Package
2N3791	TO-3	2N6246	TO-3
2N3792	TO-3	2N6247	TO-3
2N3795	TO-5	2N5415	TO-39
2N3863	TO-3	2N3055	TO-3
2N3864	TO-3	2N3442	TO-3
2N3865	TO-3	2N6262	TO-3
2N3902	TO-3	2N5840	TO-3
		BUX18C	TO-3
2N3945	TO-5	2N2102	TO-39
		2N2270	TO-39
2N4000	TO-39	2N5320	TO-39
2N4002	TO-63	2N3265	TO-63
2N4004	Radial	2N3263	Radial
2N4030	TO-39	2N4036	TO-39
2N4054	TO-202	RCP113C	TO-202
2N4055	TO-202	RCP113B	TO-202
2N4056	TO-202	RCP113B	TO-202
2N4057	TO-202	RCP113B	TO-202
2N4070	TO-3	2N5038	TO-3
2N4071	TO-3	2N6249	TO-3
2N4130	TO-3	2N3055	TO-3
2N4210	TO-63	2N3266	TO-63
2N4211	TO-63	2N3265	TO-63
2N4231	TO-66	2N6374	TO-66
2N4232	TO-66	2N6373	TO-66
2N4233	TO-66	2N6372	TO-66
2N4234	TO-39	2N5783	TO-39
2N4235	TO-39	2N5782	TO-39
2N4236	TO-39	2N5781	TO-39
2N4237	TO-39	2N5786	TO-39
2N4238	TO-39	2N5785	TO-39
2N4239	TO-39	2N5784	TO-39
2N4387	TO-66	2N5956	TO-66
2N4388	TO-66	2N5955	TO-66
2N4404	TO-39	2N1893	TO-39
2N4405	TO-39	2N2405	TO-39
2N4438	TO-39	2N3439	TO-39
2N4890	TO-39	2N4037	TO-39
2N4898	TO-66	2N5956	TO-66
2N4899	TO-66	2N5955	TO-66
2N4900	TO-66	2N5954	TO-66
2N4901	TO-3	2N6469	TO-3
2N4902	TO-3	2N6246	TO-3
2N4903	TO-3	2N6247	TO-3
2N4904	TO-3	2N6469	TO-3
2N4905	TO-3	2N6246	TO-3
2N4906	TO-3	2N6247	TO-3
2N4907	TO-3	2N6246	TO-3
2N4908	TO-3	2N6246	TO-3
2N4909	TO-3	2N6247	TO-3
2N4910	TO-66	2N6260	TO-66
		2N6374	TO-66
2N4911	TO-66	2N3054	TO-66
		2N6373	TO-66
2N4912	TO-66	2N6261	TO-66
		2N6372	TO-66
2N4913	TO-3	2N6253	TO-3
		2N6470	TO-3
2N4914	TO-3	2N3055	TO-3
		2N6472	TO-3
2N4915	TO-3	2N6254	TO-3
		2N6472	TO-3

Industry Type	Package	RCA Type	Package
2N4918	Case 77	BD240	TO-220
2N4919	Case 77	BD240A	TO-220
2N4920	Case 77	BD240B	TO-220
2N4921	Case 77	BD239	TO-220
2N4922	Case 77	BD239A	TO-220
2N4923	Case 77	BD239B	TO-220
2N4926	TO-39	2N3440	TO-39
		BF258	TO-39
2N4927	TO-39	2N3440	TO-39
		BF258	TO-39
2N4928	TO-39	BFT28	TO-39
2N4929	TO-39	BFT28A	TO-39
2N4930	TO-39	2N5415	TO-39
		BFT28B	TO-39
2N4931	TO-39	2N5416	TO-39
		BFT28C	TO-39
2N5050	TO-66	2N3584	TO-66
2N5051	TO-66	2N3584	TO-66
2N5052	TO-66	2N3584	TO-66
2N5058	TO-39	2N3439	TO-39
		BF259	TO-39
2N5059	TO-39	2N3440	TO-39
		BF258	TO-39
2N5067	TO-3	2N6253	TO-3
		2N6470	TO-3
2N5068	TO-3	2N3055	TO-3
		2N6472	TO-3
2N5069	TO-3	2N6254	TO-3
		2N6472	TO-3
2N5091	TO-5	2N5416	TO-39
2N5092	TO-5	2N3439	TO-39
2N5110	TO-5	2N5783	TO-39
2N5157	TO-3	2N5840	TO-3
2N5190	Case 77	BD241	TO-220
2N5191	Case 77	BD241A	TO-220
2N5192	Case 77	BD241B	TO-220
2N5193	Case 77	BD242	TO-220
2N5194	Case 77	BD242A	TO-220
2N5195	Case 77	BD242B	TO-220
2N5241	TO-3	2N6513	TO-3
		BUX18C	TO-3
2N5264	TO-3	2N6510	TO-3
2N5279	TO-5	2N3439	TO-39
2N5280	Flange	2N4036	TO-39FL
2N5281	TO-5	2N5415	TO-39
2N5282	TO-5	2N5416	TO-39
2N5294	TO-220	2N5294	TO-220
2N5296	TO-220	2N5298	TO-220
2N5298	TO-220	2N5298	TO-220
2N5301	TO-3	2N3771	TO-3
		2N6258	TO-3
2N5302	TO-3	2N6258	TO-3
		BDY29	TO-3
2N5303	TO-3	2N6258	TO-3
2N5305	TO-3	BDY29	TO-3
2N5331	TO-63	2N3265	TO-63
2N5344	TO-66	2N6211	TO-66
2N5345	TO-66	2N6212	TO-66
2N5427	TO-66	2N6372	TO-66
2N5429	TO-66	2N6465	TO-66
2N5539	TO-63	2N3265	TO-63
2N5560	TO-63	2N3265	TO-63

Industry Type	Package	RCA Type	Package
2N5598	TO-66	2N5202	TO-66
2N5600	TO-66	2N6500	TO-66
2N5602	TO-66	2N3879	TO-66
2N5604	TO-66	2N6500	TO-66
2N5606	TO-66	2N3879	TO-66
2N5608	TO-66	2N3879	TO-66
2N5610	TO-66	2N6500	TO-66
2N5612	TO-66	2N6500	TO-66
2N5614	TO-3	2N5039	TO-3
2N5616	TO-3	2N5038	TO-3
2N5618	TO-3	2N5038	TO-3
2N5620	TO-3	2N6496	TO-3
2N5622	TO-3	2N5039	TO-3
2N5624	TO-3	2N5038	TO-3
2N5626	TO-3	2N5038	TO-3
2N5628	TO-3	2N6496	TO-3
2N5629	TO-3	2N4348	TO-3
		2N6259	TO-3
2N5630	TO-3	2N4348	TO-3
		2N6259	TO-3
2N5631	TO-3	2N3773	TO-3
		2N6259	TO-3
2N5632	TO-3	2N4348	TO-3
2N5633	TO-3	2N4348	TO-3
2N5634	TO-3	2N3773	TO-3
		BDY37	TO-3
2N5655	Case 77	2N6175	TO-5P
2N5656	Case 77	2N6176	TO-5P
2N5657	Case 77	2N6177	TO-5P
2N5660	TO-66	2N6077	TO-66
2N5661	TO-66	2N6079	TO-66
2N5664	TO-66	2N6077	TO-66
2N5665	TO-66	2N6079	TO-66
2N5672	TO-63	2N3265	TO-63
2N5678	TO-63	2N3265	TO-63
2N5685	TO-3	2N5578	Mod. TO-3
2N5686	TO-3	2N5578	Mod. TO-3
2N5687	TO-39	40412	TO-39
2N5732	TO-3	2N5671	TO-3
2N5733	TO-63	2N3265	TO-63
2N5734	TO-3	2N5671	TO-3
2N5737	TO-3	2N6246	TO-3
2N5738	TO-3	2N6248	TO-3
2N5758	TO-3	2N3442	TO-3
		2N6262	TO-3
2N5759	TO-3	2N3442	TO-3
		2N6262	TO-3
2N5760	TO-3	2N3442	TO-3
		2N6262	TO-3
2N5861	TO-39	2N5321	TO-39
2N5864	TO-39	40634	TO-39
2N5865	TO-39	40634	TO-39
2N5867	TO-3	2N6246	TO-3
2N5868	TO-3	2N6247	TO-3
2N5869	TO-3	2N6471	TO-3
2N5870	TO-3	2N6472	TO-3
2N5871	TO-3	2N6246	TO-3
2N5872	TO-3	2N6247	TO-3
2N5873	TO-3	2N6471	TO-3
2N5874	TO-3	2N6472	TO-3

POWER TRANSISTORS (CONT'D)

Industry Type	Package	RCA Type	Package
2N5875	TO-3	2N6246	TO-3
2N5876	TO-3	2N6247	TO-3
2N5877	TO-3	2N6471	TO-3
2N5878	TO-3	2N6472	TO-3
2N5879	TO-3	2N6246	TO-3
2N5880	TO-3	2N6247	TO-3
2N5881	TO-3	2N6471	TO-3
2N5882	TO-3	2N6472	TO-3
2N5885	TO-3	2N6258	TO-3
2N5886	TO-3	2N6258	TO-3
2N5929	TO-3	2N5671	TO-3
2N5930	TO-3	2N5672	TO-3
2N5932	TO-3	2N5671	TO-3
2N5933	TO-3	2N5672	TO-3
2N5935	TO-3	2N6032	Mod. TO-3
2N5936	TO-3	2N6033	Mod. TO-3
2N5966	TO-63	2N3265	TO-63
2N5968	TO-63	2N3265	TO-63
2N5970	TO-3	2N6472	TO-3
2N5971	TO-3	2N6472	TO-3
2N5972	TO-3	2N6472	TO-3
2N5974	Case 90	2N6489	TO-220
2N5975	Case 90	2N6490	TO-220
2N5976	Case 90	2N6491	TO-220
2N5977	Case 90	2N6486	TO-220
2N5978	Case 90	2N6487	TO-220
2N5979	Case 90	2N6488	TO-220
2N5980	Case 90	2N6489	TO-220
2N5981	Case 90	2N6490	TO-220
2N5982	Case 90	2N6491	TO-220
2N5983	Case 90	2N6486	TO-220
2N5984	Case 90	2N6487	TO-220
2N5985	Case 90	2N6488	TO-220
2N5986	Case 90	2N6489	TO-220
2N5987	Case 90	2N6490	TO-220
2N5988	Case 90	2N6491	TO-220
2N5989	Case 90	2N6486	TO-220
2N5990	Case 90	2N6487	TO-220
2N5991	Case 90	2N6488	TO-220
2N6034	Case 77	RCA8203 BDX34	TO-220 TO-220
2N6035	Case 77	RCA125 BDX34A	TO-220 TO-220
2N6036	Case 77	RCA126 BDX34B	TO-220 TO-220
2N6037	Case 77	2N6386 BDX33	TO-220 TO-220
2N6038	Case 77	RCA120 BDX33A	TO-220 TO-220
2N6039	Case 77	RCA121 BDX33B	TO-220 TO-220
2N6040	Case 199	RCA125 BDX34A	TO-220 TO-220
2N6041	Case 199	RCA126 BDX34B	TO-220 TO-220
2N6042	Case 199	RCA126 BDX34C	TO-220 TO-220
2N6043	Case 199	RCA120 BDX33A	TO-220 TO-220
2N6044	Case 199	RCA121 BDX33B	TO-220 TO-220

Industry Type	Package	RCA Type	Package
2N6045	Case 199	2N6531 BDX33C	TO-220 TO-220
2N6046	TO-63	2N3266	TO-63
2N6047	TO-63	2N3265	TO-63
2N6248	TO-63	2N3265	TO-63
2N6049	TO-66	2N5955	TO-66
2N6050	TO-3	RCA8350A	TO-3
2N6051	TO-3	RCA8350B	TO-3
2N6053	TO-3	RCA8350A	TO-3
2N6054	TO-3	RCA8350B	TO-3
2N6057	TO-3	2N6384	TO-3
2N6058	TO-3	2N6385	TO-3
2N6062	TO-63	2N3265	TO-63
2N6063	TO-63	2N3265	TO-63
2N6121	TO-220	2N6290	TO-220
2N6122	TO-220	2N6292	TO-220
2N6123	TO-220	RCA31B BD241B	TO-220 TO-220
2N6124	TO-220	2N6109	TO-220
2N6125	TO-220	2N6107	TO-220
2N6126	TO-220	RCA32B BD242B	TO-220 TO-220
2N6129	TO-220	2N6290	TO-220
2N6130	TO-220	2N6292	TO-220
2N6131	TO-220	2N6292	TO-220
2N6132	TO-220	2N6109	TO-220
2N6133	TO-220	2N6107	TO-220
2N6134	TO-220	RCA32B BD242B	TO-220 TO-220
2N6226	TO-3	2N6248	TO-3
2N6229	TO-3	2N6248	TO-3
2N6233	TO-66	2N3583 2N6077	TO-66 TO-66
2N6234	TO-66	2N3584 2N6077	TO-66 TO-66
2N6235	TO-66	2N3585 2N6079	TO-66 TO-66
2N6270	TO-3	2N5671	TO-3
2N6271	TO-3	2N5672	TO-3
2N6272	TO-63	2N3265	TO-63
2N6273	TO-63	2N3265	TO-63
2N6294	TO-66	2N6534	TO-66
2N6295	TO-66	2N6534	TO-66
2N6296	TO-66	RCA8350A	TO-3
2N6297	TO-66	RCA8350B	TO-3
2N6298	TO-66	RCA8350A	TO-3
2N6299	TO-66	RCA8350B	TO-3
2N6300	TO-66	2N6534	TO-66
2N6301	TO-66	2N6534	TO-66
2N6302	TO-3	2N3773	TO-3
2N6312	TO-66	2N6308 2N5956	TO-3 TO-66
2N6313	TO-66	2N5955	TO-66
2N6314	TO-66	2N5954	TO-66
2N6338	TO-3	2N5672	TO-3
2N6339	TO-3	2N5672	TO-3
2N6359	TO-3	2N3773	TO-3
2N6360	TO-3	2N4348	TO-3
2N6406	Case 77	RCP700B	TO-202
2N6407	Case 77	RCP700C	TO-202
2N6408	Case 77	RCP701B	TO-202
2N6409	Case 77	RCP701C	TO-202

Industry Type	Package	RCA Type	Package
2N6412	Case 77	RCP701A	TO-202
2N6413	Case 77	RCP701B	TO-202
2N6414	Case 77	RCP700A	TO-202
2N6415	Case 77	RCP700B	TO-202
2N6415	Case 77	RCP701C	TO-202
2N6417	Case 77	RCP701D	TO-202
2N6418	Case 77	RCP700C	TO-202
2N6419	Case 77	RCP700D	TO-202
2N6420	TO-66	2N6211	TO-66
2N6421	TO-66	2N6212	TO-66
2N6422	TO-66	2N6212	TO-66
2N6423	TO-66	2N6212	TO-66
2N6424	TO-66	2N6211	TO-66
2N6425	TO-66	2N6212	TO-66
2N6436	TO-3	2N5671	TO-3
2N6437	TO-3	2N5672	TO-3
2N6438	TO-3	2N5672	TO-3
2N6461	TO-39	2N3439	TO-39
2N6542	TO-3	2N6510	TO-3
2N6543	TO-3	2N6510	TO-3
2N6544	TO-3	2N6510	TO-3
2N6545	TO-3	2N6510	TO-3
2N6551	TO-202	RCP701B	TO-202
2N6552	TO-202	RCP701C	TO-202
2N6553	TO-202	RCP701D	TO-202
2N6554	TO-202	RCP700B	TO-202
2N6555	TO-202	RCP700C	TO-202
2N6556	TO-202	RCP700D	TO-202
2N6557	TO-202	RCP111B RCP113B	TO-202 TO-202
2N6558	TO-202	RCP111C RCP113C	TO-202 TO-202
2N6559	TO-202	RCP111D RCP113D	TO-202 TO-202
2N6569	TO-3	2N3055	TO-3
2SA489	TO-220	2N6107	TO-220
2SA490	TO-220	2N6109	TO-220
2SA503	TO-39	2N4314	TO-39
2SA504	TO-39	2N4037	TO-39
2SA512	TO-39	2N4314	TO-39
2SA560	TO-39	2N4314	TO-39
2SA597	TO-39	2N4037	TO-39
2SA814	TO-220	2N6476	TO-220
2SA815	TO-220	2N6475	TO-220
2SB502A	TO-66	2N5954	TO-66
2SB503A	TO-66	2N5955	TO-66
2SB530	TO-3	2N6248	TO-3
2SB531	TO-3	2N6247	TO-3
2SB558	TO-3	2N6248	TO-3
2SB595	TO-220	2N6475	TO-220
2SB596	TO-220	2N6107	TO-220
2SC481	TO-39	2N699	TO-39
2SC482	TO-39	2N1613	TO-39
2SC485	TO-39	2N1893	TO-39
2SC504	TO-39	2N1711	TO-39
2SC512	TO-39	2N699	TO-39
2SC558	TO-3	BUX17A	TO-3
2SC560	TO-39	2N2405	TO-39
2SC779	TO-66	2N3584	TO-66
2SC782	TO-66	2N3585	TO-66
2SC782A	TO-66	2N3585	TO-66
2SC783	TO-66	2N3583	TO-66

Power Devices Cross-Reference Guide

(Industry Type to Equivalent RCA Type)

POWER TRANSISTORS (CONT'D)

Industry Type	Package	RCA Type	Package
2SC789	TO-220	2N6292	TO-220
2SC790	TO-220	2N6290	TO-220
2SC792	TO-3	BUX16B	TO-3
2SC1173	TO-220	2N6288	TO-220
2SC1195	TO-3	BUX16	TO-3
2SC1448A	TO-220	TA8863	TO-220
2SC1576	TO-3	BUX16	TO-3
2SD102	TO-66	2N6261	TO-66
2SD129	TO-66	2N6372	TO-66
2SD130	TO-66	2N3054	TO-66
2SD234	TO-220	RCA3054	TO-220
2SD235	TO-220	RCA3054	TO-220
2SD369	TO-3	2N3055	TO-3
2SD371	TO-3	2N6254	TO-3
2SD404C	TO-220	2N6288	TO-220
2SD424	TO-3	2N6262	TO-3
2SD425	TO-3	2N3442	TO-3
2SD427	TO-3	2N4347	TO-3
2SD428	TO-3	2N4348	TO-3
2SD523	TO-3	2N6384	TO-3
2SD524	TO-3	2N6385	TO-3
2SD526	TO-220	2N6292	TO-220
2SD552	TO-3	BUX17A	TO-3
73T2	TO-39FL	40392	TO-39FL
74T2	TO-39FL	40628	TO-39FL
100T2	TO-3	2N4347	TO-3
104T2	TO-3	2N6253	TO-3
108T2	TO-3	2N5039	TO-3
109T2	TO-3	2N6354	TO-3
182T2A	TO-3	BUX16	TO-3
182T2B	TO-3	BUX16	TO-3
182T2C	TO-3	BUX16	TO-3
184T2A	TO-3	BUX16	TO-3
183T2B	TO-3	BUX16	TO-3
183T2C	TO-3	BUX16	TO-3
183T2A	TO-3	BUX16	TO-3
184T2B	TO-3	BUX16	TO-3
184T2C	TO-3	BUX16	TO-3
185T2A	TO-3	BUX16A	TO-3
185T2B	TO-3	BUX16A	TO-3
185T2C	TO-3	BUX16A	TO-3
40250	TO-66	2N3054	TO-66
40251	TO-3	2N3055	TO-3
40636	TO-3	2N3055	TO-3
BC119	TO-39	2N697	TO-39
BC120	TO-39	2N697	TO-39
BC139	TO-39	40406	TO-39
BC140	TO-39	2N5321	TO-39
BC141	TO-39	2N5320	TO-39
BC142	TO-39	40360	TO-39
BC143	TO-39	40595	TO-39
BC144	TO-39	40594	TO-39
BC160	TO-39	2N5323	TO-39
BC161	TO-39	2N5322	TO-39
BC300	TO-39	2N1893	TO-39
BC301	TO-39	2N699	TO-39
BC302	TO-39	2N2270	TO-39
BC303	TO-39	2N4314	TO-39
BC304	TO-39	2N4037	TO-39
BC310	TO-39	2N1893	TO-39
BC311	TO-39	2N4314	TO-39
BC323	TO-39	2N5320	TO-39
BC324	TO-39	2N5320	TO-39
BC429	TO-39	2N2270	TO-39
BC430	TO-39	2N2270	TO-39
BC440	TO-39	2N5321	TO-39
BC441	TO-39	2N5320	TO-39
BC460	TO-39	2N5323	TO-39
BC461	TO-39	2N5322	TO-39
BCW44	TO-39	40360	TO-39
BCW45	TO-39	40362	TO-39
BCW77-16	TO-39	2N1711	TO-39
BCW78-16	TO-39	2N1711	TO-39
BCW79-16	TO-39	2N4037	TO-39
BCW80-16	TO-39	2N4037	TO-39
BCY40	TO-39	2N4037	TO-39
BCY54	TO-39	2N4036	TO-39
BD115	TO-39	BF258	TO-39
BD116	TO-3	2N3055	TO-3
BD141	TO-3	2N4347	TO-3
BD144	TO-3	BUX18C	TO-3
BD148	TO-66	BDY71	TO-66
BD149	TO-66	BDY71	TO-66
BD160	TO-3	2N6510	TO-3
BD162	TO-66	40250	TO-66
BD163	TO-66	2N6260	TO-66
BD185	TO-126	BD239	TO-220
BD186	TO-126	BD240	TO-220
BD187	TO-126	BD239	TO-220
BD188	TO-126	BD240	TO-220
BD189	TO-126	BD239A	TO-220
BD190	TO-126	BD240A	TO-220
BD191	TO-66	2N3054	TO-66
BD192	TO-66	2N6260	TO-66
BD195	Case 90	BD243	TO-220
BD196	Case 90	BD244	TO-220
BD197	Case 90	BD243A	TO-220
BD198	Case 90	BD244A	TO-220
BD199	Case 90	CD243B	TO-220
BD200	Case 90	BD244B	TO-220
BD201	Case 199	BD243	TO-220
BD202	Case 199	BD244	TO-220
BD203	Case 199	BD243A	TO-220
BD204	Case 199	BD244A	TO-220
BD205	Case 90	2N6486	TO-220
BD206	Case 90	2N6489	TO-220
BD207	Case 90	2N6487	TO-220
BD208	Case 90	2N6490	TO-220
BD213-45	TO-3P	2N6486	TO-220
BD213-60	TO-3P	2N6487	TO-220
BD213-80	TO-3P	2N6489	TO-220
BD214-45	TO-3P	2N6489	TO-220
BD214-60	TO-3P	2N6490	TO-220
BD214-80	TO-3P	2N6491	TO-220
BD215	TO-66	2N3584	TO-66
BD216	TO-66	2N3585	TO-66
BD244A	TO-220	BD244A	TO-220
BD244B	TO-220	BD244B	TO-220
BD244C	TO-220	BD244C	TO-220
BD245	TO-3P	2N6486	TO-220
BD245A	TO-3P	2N6487	TO-220
BD245B	TO-3P	2N6488	TO-220
BD246	TO-3P	2N6489	TO-220
BD246A	TO-3P	2N6490	TO-220
BD246B	TO-3P	2N6491	TO-220
BD253	TO-3	BUX18B	TO-3
BD253A	TO-3	BUX18C	TO-3
BD253B	TO-3	BU126	TO-3
BD253C	TO-3	TA8764	TO-3
BD260	TO-66	2N3584	TO-66
BD261	TO-66	2N3584	TO-66
BD264	TO-220	RCA8203A	TO-220
BD264A	TO-220	RCA8203B	TO-220
BD264B	TO-220	BDX34C	TO-220
BD265	TO-220	2N6387	TO-220
BD265A	TO-220	2N6388	TO-220
BD265B	TO-220	BDX33C	TO-220
BD266	TO-220	BDX34A	TO-220
BD266A	TO-220	BDX34B	TO-220
BD266B	TO-220	BDX34C	TO-220
BD267	TO-220	BDX33A	TO-220
BD267A	TO-220	BDX33B	TO-220
BD267B	TO-220	BDX33C	TO-220
BD268	TO-220	BDX34A	TO-220
BD268A	TO-220	BDX34B	TO-220
BD269	TO-220	BDX33A	TO-220
BD269A	TO-220	BDX33B	TO-220
BD271	TO-220	BD241	TO-220
BD272	TO-220	BD242	TO-220
BD273	TO-220	BD241A	TO-220
BD274	TO-220	BD242A	TO-220
BD275	TO-220	BD241B	TO-220
BD276	TO-220	BD242B	TO-220
BD291	SOT-82	BD243	TO-220
BD292	SOT-82	BD244	TO-220
BD293	SOT-82	BD243A	TO-220
BD294	SOT-82	BD244A	TO-220
BD301	TO-220	BD243	TO-220
BD302	TO-220	BD244	TO-220
BD303	TO-220	BD243A	TO-220
BD304	TO-220	BD244A	TO-220
BD311	TO-3	2N6471	TO-3
BD312	TO-3	2N6246	TO-3
BD313	TO-3	2N6472	TO-3
BD314	TO-3	2N6247	TO-3
BD315	TO-3	2N6472	TO-3
BD316	TO-3	2N6247	TO-3
BD317	TO-3	2N6472	TO-3
BD318	TO-3	2N6248	TO-3
BD375	TO-126	BD239	TO-220
BD376	TO-126	BD240	TO-220
BD377	TO-126	BD239A	TO-220
BD378	TO-126	BD240A	TO-220
BD379	TO-126	BD239B	TO-220
BD380	TO-126	BD240B	TO-220
BD410	TO-126	RCP111D	TO-202
BD515	TO-202	RCP701A	TO-202
BD516	TO-202	RCP700A	TO-202
BD517	TO-202	RCP701B	TO-202
BD518	TO-202	RCP701C	TO-202

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(Industry Type to Equivalent RCA Type)

POWER TRANSISTORS (CONT'D)

Industry Type	Package	RCA Type	Package
BD519	TO-202	RCP701C	TO-202
BD520	TO-202	RCP700C	TO-202
BD525	TO-202	RCP701B	TO-202
BD526	TO-202	RCP700B	TO-202
BD527	TO-202	RCP701C	TO-202
BD528	TO-202	RCP700C	TO-202
BD529	TO-202	RCP701D	TO-202
BD530	TO-202	RCP700D	TO-202
BD575	Case 199	BD241	TO-220
BD576	Case 199	BD242	TO-220
BD577	Case 199	BD241A	TO-220
BD578	Case 199	BD242A	TO-220
BD579	Case 199	BD241B	TO-220
BD580	Case 199	BD242B	TO-220
BD581	Case 199	BD242C	TO-220
BD582	Case 199	BD242C	TO-220
BD585	Case 199	BD241	TO-220
BD586	Case 199	BD242	TO-220
BD587	Case 199	BD241A	TO-220
BD588	Case 199	BD242A	TO-220
BD589	Case 199	BD241B	TO-220
BD590	Case 199	BD242B	TO-220
BD591	Case 199	BD241C	TO-220
BD592	Case 199	BD242C	TO-220
BD595	Case 199	BD243	TO-220
BD596	Case 199	BD244	TO-220
BD597	Case 199	BD243A	TO-220
BD598	Case 199	BD244A	TO-220
BD599	Case 199	BD243B	TO-220
BD600	Case 199	BD244B	TO-220
BD601	Case 199	BD243C	TO-220
BD602	Case 199	BD244C	TO-220
BD605	Case 199	2N6486	TO-220
BD606	Case 199	2N6489	TO-220
BD607	Case 199	2N6487	TO-220

Industry Type	Package	RCA Type	Package
BD608	Case 199	2N6490	TO-220
BD609	Case 199	2N6488	TO-220
BD610	Case 199	2N6491	TO-220
BD633	TO-220	40979	TO-220
BD634	TO-220	40980	TO-220
BD635	TO-220	40871	TO-220
BD636	TO-220	40872	TO-220
BD637	TO-220	40871	TO-220
BD638	TO-220	40872	TO-220
BD643	TO-220	BDX33	TO-220
BD644	TO-220	BDX34	TO-220
BD645	TO-220	BDX33A	TO-220
BD646	TO-220	BDX34A	TO-220
BD647	TO-220	BDX33B	TO-220
BD648	TO-220	BDX34B	TO-220
BD661	TO-220	2N6486	TO-220
BD662	TO-220	2N6489	TO-220
BD663	TO-220	2N6486	TO-220
BD663B	TO-220	2N6486	TO-220
BD664	TO-220	2N6489	TO-220
BD695	Case 199	BDX33	TO-220
BD695A	Case 199	BDX33	TO-220
BD696	Case 199	BDX34	TO-220
BD696A	Case 199	BDX34	TO-220
BD697	Case 199	BDX33A	TO-220
BD697A	Case 199	BDX33A	TO-220
BD698	Case 199	BDX34A	TO-220
BD698A	Case 199	BDX34A	TO-220
BD699	Case 199	BDX33B	TO-220
BD699A	Case 199	BDX33B	TO-220
BD700	Case 199	BDX34B	TO-220
BD700A	Case 199	BDX34B	TO-220
BD701	Case 199	BDX33C	TO-220
BD702	Case 199	BDX34C	TO-220
BD705	TO-220	2N6486	TO-220
BD706	TO-220	2N6489	TO-220
BD707	TO-220	2N6487	TO-220
BD708	TO-220	2N6490	TO-220
BD709	TO-220	2N6488	TO-220
BD710	TO-220	2N6491	TO-220
BDX14	TO-66	2N3054	TO-66
BDX16	TO-66	BUX66	TO-66
BDX27	TO-66	2N3879	TO-66
BDX28	TO-66	2N3879	TO-66

Industry Type	Package	RCA Type	Package
BDX30	TO-66	2N6500	TO-66
BDX53	TO-220	BDX33	TO-220
BDX53A	TO-220	BDX33A	TO-220
BDX53B	TO-220	BDX33B	TO-220
BDX53C	TO-220	BDX33C	TO-220
BDX54	TO-220	BDX34	TO-220
BDX54A	TO-220	BDX34A	TO-220
BDX54B	TO-220	BDX34B	TO-220
BDX54C	TO-220	BDX34C	TO-220
BDX60	TO-3	2N6254	TO-3
BDX61	TO-3	2N3055	TO-3
BDX62	TO-3	RCA8350A	TO-3
BDX62A	TO-3	RCA8350B	TO-3
BDX63	TO-3	2N6384	TO-3
BDX63A	TO-3	2N6385	TO-3
BDX64	TO-3	BDX84A	TO-3
BDX64A	TO-3	BDX84B	TO-3
BDX64B	TO-3	BDX84C	TO-3
BDX65	TO-3	BDX83A	TO-3
BDX65A	TO-3	BDX83B	TO-3
BDX65B	TO-3	BDX83C	TO-3
BDX77	TO-220	BD243B	TO-220
BDX78	TO-220	BD244B	TO-220
BDY10	TO-3	2N6253	TO-3
BDY12	TO-3	BUX16	TO-3
BDY13	TO-3	BUX16	TO-3
BDY15	TO-3	BUX16	TO-3
BDY17	TO-3	BUX16	TO-3
BDY20	TO-3	BUX16	TO-3
BDY25A	TO-3	BUX16	TO-3
BDY25B	TO-3	BUX16	TO-3
BDY25C	TO-3	BUX16	TO-3
BDY26A	TO-3	BUX16	TO-3
BDY26B	TO-3	BUX16	TO-3
BDY26C	TO-3	BUX16	TO-3
BDY27A	TO-3	BUX16	TO-3
BDY27B	TO-3	BUX16	TO-3
BDY27C	TO-3	BUX16	TO-3
BDY28A	TO-3	BUX16A	TO-3
BDY28B	TO-3	BUX16A	TO-3
BDY28C	TO-3	BUX16A	TO-3
BDY38	TO-3	2N6253	TO-3
BDY39	TO-3	2N3055	TO-3
BDY55	TO-3	2N5039	TO-3
BDY56	TO-3	2N5038	TO-3
BDY57	TO-3	41012	TO-3
BDY58	TO-3	41013	TO-3
BDY73	TO-3	2N3055	TO-3
BDY74	TO-3	2N4347	TO-3
BDY76	TO-3	2N3772	TO-3
BDY77	TO-3	2N3773	TO-3
BDY78	TO-66	2N6373	TO-66
BDY79	TO-66	2N3583	TO-66
BDY80A	TO-220	2N5296	TO-220
BDY81A	TO-220	2N5298	TO-220
BDY82A	TO-220	2N6111	TO-220
BDY83A	TO-220	2N6109	TO-220
BDY91	TO-3	2N5038	TO-3
BDY92	TO-3	2N5039	TO-3
BDY93	TO-3	BU126	TO-3
BDY94	TO-3	BU126	TO-3
BDY95	TO-3	BU126	TO-3

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(Industry Type to Equivalent RCA Type)

POWER TRANSISTORS (CONT'D)

Industry Type	Package	RCA Type	Package
BDY96	TO-3	2N6513	TO-3
BDY97	TO-3	2N6512	TO-3
BDY98	TO-3	2N6511	TO-3
BDY99	TO-3	2N6511	TO-3
BF111	TO-39	2N3440	TO-39
NF137	TO-5	BF257	TO-39
BF157	TO-39	BF257	TO-39
BF174	TO-39	BF257	TO-39
BF177	TO-39	40360	TO-39
BF178	TO-39	40412	TO-39
BF179	TO-39	BF257	TO-39
BF179A	TO-39	BF257	TO-39
BF179B	TO-39	BF258	TO-39
BF179C	TO-39	BF258	TO-39
BF305	TO-39	BF257	TO-39
BF322	TO-39	40317	TO-39
BF323	TO-39	40319	TO-39
BF336	TO-39	BF258	TO-39
BF337	TO-39	BF258	TO-39
BF338	TO-39	BF258	TO-39
BF355	TO-39	2N3440	TO-39
BF380	TO-202	RCP113A	TO-202
BF381	TO-202	RCP113B	TO-202
BF382	TO-202	RCP113C	TO-202
BF390	TO-39	BF259	TO-39
BFR19	TO-39	2N1613	TO-39
BFR20	TO-39	2N1711	TO-39
BFR21	TO-39	2N1893	TO-39
BFR22	TO-39	2N2102	TO-39
BFR23	TO-39	2N4036	TO-39
BFR24	TO-39	2N4037	TO-39
BFR56	TO-39	2N5321	TO-39
BFR57	TO-39	BF257	TO-39
BFR58	TO-39	BF258	TO-39
BFR59	TO-39	BF259	TO-39
BFR77	TO-39	2N1893	TO-39
BFR78	TO-39	2N2405	TO-39
BFS90	TO-39	40987	TO-39
BFS90A	TO-39	40987	TO-39
BFS91	TO-39	40999	TO-39
BFS91A	TO-39	40999	TO-39
BFS92	TO-39	2N4036	TO-39
BFS93	TO-39	2N4314	TO-39
BFS94	TO-39	2N4037	TO-39
BFS95	TO-39	2N4037	TO-39
BFT32	TO-39	40635	TO-39
BFT33	TO-39	40409	TO-39HR
BFT34	TO-39	2N2405	TO-39
BFT35	TO-39	2N4314	TO-39
BFT36	TO-39	40410	TO-39HR
BFT39	TO-39	40409	TO-39HR
BFT40	TO-39	40628	TO-39HR
BFT41	TO-39	40628	TO-39HR
BFT44	TO-39	BF259	TO-39
BFT45	TO-39	BF258	TO-39
BFT60	TO-39	2N4037	TO-39
BFT61	TO-39	2N4037	TO-39
BFT62	TO-39	40815	TO-39
BFT80	TO-39	40815	TO-39
BFW24	TO-39	2N2102	TO-39
BFW25	TO-39	2N1711	TO-39
BFW26	TO-39	2N697	TO-39
BFW33	TO-39	2N1893	TO-39
BFW44	TO-39	BFT19	TO-39
BFW45	TO-39	BF257	TO-39
BFX17	TO-39	2N3053	TO-39
BFX29	TO-39	2N4036	TO-39
BFX30	TO-39	2N4036	TO-39
BFX39	TO-39	2N4036	TO-39
BFX68	TO-39	2N1711	TO-39
BFX68A	TO-39	2N1711	TO-39
BFX69	TO-39	2N697	TO-39
BFX69A	TO-39	2N1613	TO-39
BFX74	TO-39	2N4037	TO-39
BFX74A	TO-39	2N4314	TO-39
BFX85	TO-39	2N2405	TO-39
BFX86	TO-39	2N1711	TO-39
BFX87	TO-39	2N4036	TO-39
BFX88	TO-39	2N4037	TO-39
BFX91	TO-39	BFT28B	TO-39
BFX98	TO-39	BF257	TO-39
BFY10	TO-39	40814	TO-39
BFY11	TO-39	40814	TO-39
BFY17	TO-39	40317	TO-39
BFY33	TO-39	2N697	TO-39
BFY34	TO-39	2N697	TO-39
BFY40	TO-39	40320	TO-39
BFY43	TO-39	BF257	TO-39
BFY44	TO-39	2N2102	TO-39
BFY45	TO-39	40408	TO-39
BFY46	TO-39	2N1711	TO-39
BFY50	TO-39	2N697	TO-39
BFY51	TO-39	2N697	TO-39
BFY52	TO-39	2N3053	TO-39
BFY55	TO-39	2N697	TO-39
BFY56	TO-39	2N699	TO-39
BFY57	TO-39	BF257	TO-39
BFY67	TO-39	2N3053	TO-39
BFY67A	TO-39	2N1613	TO-39
BFY68	TO-39	2N1711	TO-39
BFY70	TO-39	2N3053	TO-39
BFY94	TO-39	40594	TO-39
BSS15	TO-39	2N5320	TO-39
BSS16	TO-39	2N5321	TO-39
BSS17	TO-39	2N5322	TO-39
BSS18	TO-39	2N5323	TO-39
BSS30	TO-39	2N2102	TO-39
BSS32	TO-39	2N2405	TO-33
BSS45	TO-39	2N5320	TO-39
BSS46	TO-39	2N5322	TO-39
BSS48	TO-39	2N3440	TO-39
BSS49	TO-39	2N3439	TO-39
BSV15	TO-39	2N4037	TO-39
BSV15-6	TO-39	2N4037	TO-39
BSV15-10	TO-39	2N4037	TO-39
BSV16	TO-39	2N4314	TO-39
BSV16-6	TO-39	2N4314	TO-39
BSV16-10	TO-39	2N4314	TO-39
BSV17	TO-39	2N5322	TO-39
BSV69	TO-39	2N5321	TO-39
BSV77	TO-39	2N5321	TO-39
BSV84	TO-39	2N1893	TO-39
BSW23	TO-39	2N4037	TO-39
BSW39	TO-39	2N1893	TO-39
BSX22	TO-39	2N5321	TO-39
BSX23	TO-39	2N5320	TO-39
BSX40	TO-39	2N4037	TO-39
BSX45	TO-39	2N3053	TO-39
BSX46	TO-39	2N2102	TO-39
BSX47	TO-39	2N1893	TO-39
BSX59	TO-39	2N5321	TO-39
BSX60	TO-39	2N5321	TO-39
BSX61	TO-39	2N5321	TO-39
BSX72	TO-39	2N3053	TO-39
BSX95	TO-39	2N1613	TO-39
BSX96	TO-39	2N1711	TO-39
BSY25	TO-39	2N697	TO-39
BSY44	TO-39	2N699	TO-39
BSY45	TO-39	2N1893	TO-39
BSY46	TO-39	2N699	TO-39
BSY51	TO-39	2N697	TO-39
BSY52	TO-39	2N1711	TO-39
BSY53	TO-39	2N697	TO-39
BSY54	TO-39	2N1711	TO-39
BSY55	TO-39	2N1893	TO-39
BSY68	TO-39	2N2405	TO-39
BSY71	TO-39	2N1711	TO-39
BSY81	TO-39	2N697	TO-39
BSY82	TO-39	2N1711	TO-39
BSY83	TO-39	2N697	TO-39
BSY84	TO-39	2N1711	TO-39
BSY85	TO-39	2N1893	TO-39
BSY87	TO-39	2N2102	TO-39
BSY91	TO-39	2N697	TO-39
BSY92	TO-39	2N1711	TO-39
BU102	TO-3	BUX18B	TO-3
BU111	TO-3	2N6512	TO-3
BU114	TO-3	2N6510	TO-3
BU121	TO-3	BUX18	TO-3
BU129	TO-3	BUX18C	TO-3
BU134	TO-3	BU126	TO-3
BU135	TO-3	2N6510	TO-3
BU136	TO-3	2N6510	TO-3
BU310	TO-3	BUX17	TO-3
BU311	TO-3	BUX17	TO-3
BU312	TO-3	BUX17	TO-3
BU409	TO-220	TA8863J	TO-220
BUX26	TO-3	2N6510	TO-3
BUX27	TO-3	BUX18C	TO-3
BUX39	TO-3	2N5038	TO-3
BUX40	TO-3	2N6354	TO-3
BUX41	TO-3	BUX17A	TO-3
BUX42	TO-3	BUX17B	TO-3
BUX43	TO-3	BUX17C	TO-3
BUX44	TO-3	BUX18C	TO-3
BUX84	TO-220	TA8863A	TO-220
BUY35	TO-3	2N6511	TO-3
BUY43	TO-66	BDY71	TO-66
BUY46	TO-66	2N3054	TO-66
BUY55	TO-3	2N5239	TO-3
BUY56	TO-3	2N5239	TO-3
BUY66	TO-3	BU126	TO-3
BUY67	TO-3	BU126	TO-3
BUY69B	TO-3	BU126	TO-3

Power Devices Cross-Reference Guide

(Industry Type to Equivalent RCA Type)

POWER TRANSISTORS (CONT'D)

Industry Type	Package	RCA Type	Package
BUY69C	TO-3	BU126	TO-3
BUY70B	TO-3	BU126	TO-3
BUY70C	TO-3	BU126	TO-3
BUY72	TO-3	2N5239	TO-3
BUY74	TO-3	BUX18A	TO-3
BUY75	TO-3	BUX18C	TO-3
BUY76	TO-3	BU126	TO-3
BUY77	TO-3	BUX18A	TO-3
BUY78	TO-3	BUX18C	TO-3
BUY79	TO-3	BUX126	TO-3
D40D1	TO-202	RCP707	TO-202
D40D2	TO-202	RCP707	TO-202
D40D3	TO-202	RCP707	TO-202
D40D4	TO-202	RCP707	TO-202
D40D5	TO-202	RCP707	TO-202
D40D6	TO-202	RCP701B	TO-202
D40D7	TO-202	RCP701B	TO-202
D40D8	TO-202	RCP701B	TO-202
D40D10	TO-202	RCP701C	TO-202
D40D11	TO-202	RCP701C	TO-202
D40D13	TO-202	RCP701C	TO-202
D40E1	TO-202	RCP705	TO-202
D40E5	TO-202	RCP701B	TO-202
D40E7	TO-202	RCP701C	TO-202
D40N1	TO-202	RCP113B	TO-202
D40N2	TO-202	RCP111B	TO-202
D40N3	TO-202	RCP113C	TO-202
D40N4	TO-202	RCP111C	TO-202
D40N5	TO-202	RCP111C	TO-202
D40P1	TO-202	2N6175	TO-5P
D40P3	TO-202	2N6175	TO-5P
D40P5	TO-202	2N6175	TO-5P
D41D1	TO-202	RCP706	TO-202
D41D2	TO-202	RCP706B	TO-202
D41D4	TO-202	RCP706B	TO-202
D41D5	TO-202	RCP700B	TO-202
D41D6	TO-202	RCP700B	TO-202
D41D7	TO-202	RCP700B	TO-202
D41D8	TO-202	RCP700B	TO-202
D41D10	TO-202	RCP700C	TO-202
D41D11	TO-202	RCP700C	TO-202
D41D13	TO-202	RCP700C	TO-202
D41E1	TO-202	RCP704	TO-202
D41E5	TO-202	RCP700B	TO-202
D41E7	TO-202	RCP700C	TO-202
D42C1	TO-202	2N6288	TO-220
		RCP707	TO-202
D42C2	TO-202	2N6288	TO-220
		RCP705	TO-202
D42C3	TO-202	2N6288	TO-220
		RCP705	TO-202
D42C4	TO-202	2N6290	TO-220
		RCP703A	TO-202
D42C5	TO-202	2N6290	TO-220
		RCP701A	TO-202
D42C6	TO-202	2N6290	TO-220
		RCP701A	TO-202
D42C7	TO-202	2N6292	TO-220
		RCP703B	TO-202
D42C8	TO-202	2N6292	TO-220
		RCP701B	TO-202
D42C9	TO-202	2N6292	TO-220
		RCP701B	TO-202
D42C10	TO-202	2N6292	TO-220
		RCP703C	TO-202
D42C11	TO-202	2N6292	TO-220
		RCP701C	TO-202
D42C12	TO-202	RCP701C	TO-202
D43C1	TO-202	2N6111	TO-220
		RCP706	TO-202
D43C2	TO-202	2N6111	TO-220
		RCP704	TO-202
D43C3	TO-202	2N6111	TO-220
		RCP704	TO-202
D43C4	TO-202	2N6109	TO-220
		RCP702A	TO-202
D43C5	TO-202	2N6109	TO-220
		RCP700A	TO-202
D43C6	TO-202	2N6109	TO-220
		RCP700A	TO-202
D43C7	TO-202	2N6107	TO-220
		RCP702B	TO-202
D43C8	TO-202	2N6107	TO-220
		RCP700B	TO-202
D43C9	TO-202	2N6107	TO-220
		RCP700B	TO-202
D43C10	TO-202	2N6107	TO-220
		RCP700B	TO-202
D43C11	TO-202	2N6107	TO-220
		RCP700C	TO-202
D43C12	TO-202	RCP700C	TO-202
D44C1	TO-220	2N6288	TO-220
		BD239	TO-220
D44C2	TO-220	2N6288	TO-220
		BD239	TO-220
D44C3	TO-220	2N6288	TO-220
		BD239	TO-220
D44C4	TO-220	2N6290	TO-220
		BD239	TO-220
D44C5	TO-220	2N6290	TO-220
		BD239	TO-220
D44C6	TO-220	2N6290	TO-220
		BD239	TO-220
D44C7	TO-220	2N6292	TO-220
		BD239A	TO-220
D44C8	TO-220	2N6292	TO-220
		BD239A	TO-220
D44C9	TO-220	2N6292	TO-220
		BD239A	TO-220
D44C10	TO-220	2N6292	TO-220
		BD239B	TO-220
D44C11	TO-220	2N6292	TO-220
		BD239B	TO-220
D44C12	TO-220	BD239B	TO-220
D44E1	TO-220	2N6386	TO-220
D44E2	TO-220	2N6387	TO-220
D44E3	TO-220	2N6388	TO-220
D44H1	TO-220	2N6288	TO-220
D44H2	TO-220	2N6288	TO-220
D44H4	TO-220	2N6290	TO-220
D44H5	TO-220	2N6290	TO-220
D44H7	TO-220	2N6292	TO-220
D44H8	TO-220	2N6292	TO-220
D44H10	TO-220	2N6292	TO-220
D44H11	TO-220	2N6292	TO-220
D44R1	TO-220	TA8863B	TO-220
D44R2	TO-220	TA8863B	TO-220
D44R3	TO-220	TA8863B	TO-220
D44R4	TO-220	TA8863B	TO-220
D44R5	TO-220	TA8863F	TO-220
D44R6	TO-220	TA8863F	TO-220
D45C1	TO-220	2N6111	TO-220
		BD240	TO-220
D45C2	TO-220	2N6111	TO-220
		BD240	TO-220
D45C3	TO-220	2N6111	TO-220
		BD240	TO-220
D45C4	TO-220	2N6109	TO-220
		BD240	TO-220
D45C5	TO-220	2N6109	TO-220
		BD240	TO-220
D45C6	TO-220	2N6109	TO-220
		BD240	TO-220
D45C7	TO-220	2N6107	TO-220
		BD240A	TO-220
D45C8	TO-220	2N6107	TO-220
		BD240A	TO-220
D45C9	TO-220	2N6107	TO-220
		BD240A	TO-220
D45C10	TO-220	2N6107	TO-220
		BD240B	TO-220
D45C11	TO-220	2N6107	TO-220
		BD240B	TO-220
D45C12	TO-220	BD240B	TO-220
D45E1	TO-220	RCA8203	TO-220
D45E2	TO-220	RCA8203A	TO-220
D45E3	TO-220	RCA8203B	TO-220
D45H1	TO-220	2N6111	TO-220
D45H2	TO-220	2N6111	TO-220
D45H4	TO-220	2N6109	TO-220
D45H5	TO-220	2N6109	TO-220
D45H7	TO-220	2N6107	TO-220
D45H8	TO-220	2N6107	TO-220
D45H10	TO-220	2N6107	TO-220
D45H11	TO-220	2N6107	TO-220
DTS410	TO-3	RCA410	TO-3
DTS411	TO-3	RCA411	TO-3
DTS413	TO-3	RCA413	TO-3
DTS423	TO-3	RCA423	TO-3
DTS431	TO-3	RCA431	TO-3
ESM113	TO-3	2N6384	TO-3
ESM114	TO-3	2N6385	TO-3
ESM159	TO-3	RCA8350A	TO-3
ESM160	TO-3	RCA8350B	TO-3
ESM213	TO-220	2N6387	TO-220
ESM214	TO-220	2N6388	TO-220
ESM217	TO-220	2N6387	TO-220
ESM218	TO-220	2N6388	TO-220
ESM259	TO-220	RCA8203A	TO-220
ESM260	TO-220	RCA8203B	TO-220
ESM261	TO-220	RCA8203A	TO-220
ESM262	TO-220	RCA8203B	TO-220
FT410	TO-3	RCA410	TO-3

Power Devices Cross-Reference Guide

(Industry Type to Equivalent RCA Type)

POWER TRANSISTORS (CONT'D)

Industry Type	Package	RCA Type	Package
FT411	TO-3	RCA411	TO-3
FT413	TO-3	RCA413	TO-3
FT423	TO-3	RCA423	TO-3
FT431	TO-3	RCA431	TO-3
MJ400	TO-66	2N3585	TO-66
MJ410	TO-3	RCA410	TO-3
MJ411	TO-3	RCA411	TO-3
MJ413	TO-3	RCA413	TO-3
MJ420	TO-39	BF258	TO-39
MJ423	TO-3	RCA423	TO-3
MJ424	TO-3	BUX16C	TO-3
MJ425	TO-3	BUX18C	TO-3
MJ431	TO-3	RCA431	TO-3
MJ450	TO-3	2N6246	TO-3
		2N6469	TO-3
MJ480	TO-3	2N6470	TO-3
MJ481	TO-3	2N6471	TO-3
MJ490	TO-3	2N6246	TO-3
		2N6469	TO-3
MJ491	TO-3	2N6246	TO-3
MJ802	TO-3	RCS258	TO-3
MJ900	TO-3	RCA8350A	TO-3
MJ901	TO-3	RCA8350B	TO-3
MJ920	TO-3	RCA8350A	TO-3
MJ921	TO-3	RCA8350B	TO-3
MJ1000	TO-3	RCA1000	TO-3
MJ1001	TO-3	RCA1001	TO-3
MJ1200	TO-3	2N6384	TO-3
MJ1201	TO-3	2N6385	TO-3
MJ1800	TO-3	2N5838	TO-3
		BUX16C	TO-3
MJ2249	TO-66	2N3879	TO-66
MJ2250	TO-66	2N3879	TO-66
MJ2251	TO-66	2N3584	TO-66
		BUX67B	
MJ2252	TO-66	2N3585	TO-66
		BUX67C	TO-66
MJ2253	TO-66	2N5955	TO-66
MJ2254	TO-66	2N5954	TO-66
MJ2267	TO-3	2N6246	TO-3
		2N6469	TO-3
MJ2268	TO-3	2N6246	TO-3
MJ2500	TO-3	2N6649	TO-204MA●
		RCA8350A	TO-3
MJ2501	TO-3	2N6650	TO-204MA●
		RCA8350B	TO-3
MJ2801	TO-3	2N6371	TO-3
MJ2840	TO-3	2N3055	TO-3
		2N6471	TO-3
MJ2841	TO-3	2N6254	TO-3
		2N6472	TO-3
MJ2901	TO-3	2N6246	TO-3
		2N6249	TO-3
MJ2940	TO-3	2N6246	TO-3
		BDX18N	TO-3
MJ2941	TO-3	2N6247	TO-3
MJ3000	TO-3	2N6384	TO-3
MJ3001	TO-3	2N6385	TO-3
MJ3010	TO-3	BUX16B	TO-3
MJ3011	TO-3	BUX16B	TO-3
MJ3026	TO-3	2N5839	TO-3
MJ3027	TO-3	2N5840	TO-3
		BUX126	TO-3

Industry Type	Package	RCA Type	Package
MJ3028	TO-3	2N5840	TO-3
		BUX126	TO-3
MJ3029	TO-3	BUX16A	TO-3
MJ3030	TO-3	BUX16C	TO-3
MJ3101	TO-66	2N3878	TO-66
MJ3201	TO-66	BUX67A	TO-66
MJ3202	TO-66	2N3585	TO-3
		BUX67B	TO-66
MJ3430	TO-3	2N5840	TO-3
		BUX18B	TO-3
MJ3583	TO-66	2N6211	TO-3
MJ3584	TO-66	2N6212	TO-66
MJ3585	TO-66	2N6212	TO-66
MJ3701	TO-66	2N5956	TO-66
MJ3760	TO-3	BU126	TO-3
MJ3761	TO-3	BU126	TO-3
MJ3771	TO-3	2N3771	TO-3
MJ3772	TO-3	2N3772	TO-3
MJ3773	TO-3	2N3773	TO-3
MJ4000	TO-3	2N6384	TO-3
		RCA1000	TO-3
MJ4001	TO-3	2N6385	TO-3
		RCA1001	TO-3
MJ4010	TO-3	2N6649	TO-204MA●
		RCA8350A	TO-3
MJ4011	TO-3	2N6650	TO-204MA●
		RCA8350B	TO-3
MJ4240	TO-66	2N6212	TO-66
MJ4502	TO-3	2N6248	TO-3
MJ5415	TO-39	2N5415	TO-39
MJ5416	TO-39	2N5416	TO-39
MJ5600	TO-3	2N3772	TO-3
MJ5601	TO-3	2N6258	TO-3
MJ5602	TO-3	2N3773	TO-3
MJ5603	TO-3	2N3773	TO-3
MJ6000	TO-3	2N3772	TO-3
MJ6001	TO-3	2N6258	TO-3
MJ6002	TO-3	2N3773	TO-3
MJ6003	TO-3	2N6258	TO-3
MJ6004	TO-3	2N6258	TO-3
MJ6302	TO-3	2N3773	TO-3
MJ7000	TO-63	2N3265	TO-63
MJE29	Case 199	BD239	TO-220
MJE29A	Case 199	BD239A	TO-220
MJE29B	Case 199	BD239B	TO-220
MJE29C	Case 199	BD239C	TO-220
MJE30	Case 199	BD240	TO-220
MJE30A	Case 199	BD240A	TO-220
MJE30B	Case 199	BD240B	TO-220
MJE30C	Case 199	BD240C	TO-220
MJE31	Case 199	BD241	TO-220
MJE31A	Case 199	BD241A	TO-220

Industry Type	Package	RCA Type	Package
MJE31B	Case 199	BD241B	TO-220
MJE31C	Case 199	BD241C	TO-220
MJE32	Case 199	BD242	TO-220
MJE32A	Case 199	BD242A	TO-220
MJE32B	Case 199	BD242B	TO-220
MJE32C	Case 199	BD242C	TO-220
MJE33	Case 199	2N6486	TO-220
MJE33A	Case 199	2N6487	TO-220
MJE33B	Case 199	2N6488	TO-220
MJE34	Case 199	2N6489	TO-220
MJE34A	Case 199	2N6490	TO-220
MJE34B	Case 199	2N6491	TO-220
MJE41	Case 199	BD243	TO-220
MJE41A	Case 199	BD243A	TO-220
MJE41B	Case 199	BD243B	TO-220
MJE41C	Case 199	BD243C	TO-220
MJE42	Case 199	BD244	TO-220
MJE42A	Case 199	BD244A	TO-220
MJE42B	Case 199	BD244C	TO-220
MJE42C	Case 199	BD244C	TO-220
MJE47	Case 199	TA8863C	TO-220
MJE48	Case 199	TA8863B	TO-220
MJE49	Case 199	TA8863A	TO-220
MJE105	Case 90	BD278A	TO-220
MJE105K	Case 199	BD278A	TO-220
MJE205	Case 90	2N6290	TO-220
		BD277	TO-220
MJE205K	Case 199	BD277	TO-220
MJE340K	Case 199	TA8863B	TO-220
MJE341K	Case 199	TA8863J	TO-220
MJE344K	Case 199	TA8865J	TO-220
MJE370	Case 77	RCA30	TO-220
MJE370K	Case 199	BD242	TO-220

● JEDEC TO-204MA was formerly designated JEDEC TO-3.

Power Devices Cross-Reference Guide

(Industry Type to Equivalent RCA Type)

POWER TRANSISTORS (CONT'D)

Industry Type	Package	RCA Type	Package
MJE371	Case 77	RCA30	TO-220
MJE520	Case 77	RCA29	TO-220
MJE520K	Case 199	BD241	TO-220
MJE521	Case 77	RCA29	TO-220
MJE700	TO-126	RCA125	TO-220
		RCA8203A	TO-220
MJE701	TO-126	RCA125	TO-220
		RCA8203A	TO-220
MJE702	TO-126	RCA126	TO-220
		RCA8203B	TO-220
MJE703	TO-126	RCA126	TO-220
		RCA8203B	TO-220
MJE800	TO-126	2N6387	TO-220
		RCA120	TO-220
MJE801	TO-126	2N6387	TO-220
		RCA120	TO-220
MJE802	TO-126	2N6388	TO-220
		RCA121	TO-220
MJE803	TO-126	2N6388	TO-220
		RCA121	TO-220
MJE1090	Case 90	RCA8203A	TO-220
		BDX34A	TO-220
MJE1091	Case 90	RCA8203A	TO-220
		BDX34A	TO-220
MJE1092	Case 90	RCA8203A	TO-220
		BDX34B	TO-220
MJE1093	Case 90	RCA8203A	TO-220
		BDX34B	TO-220
MJE1100	Case 90	2N6387	TO-220
		BDX33A	TO-220
MJE1101	Case 90	2N6387	TO-220
		BDX33A	TO-220
MJE1102	Case 90	2N6388	TO-220
		BDX33B	TO-220
MJE1103	Case 90	2N6388	TO-220
		BDX33B	TO-220
MJE1290	Case 90	2N6489	TO-220
MJE1291	Case 90	2N6490	TO-220
MJE1660	Case 90	2N6486	TO-220
MJE1661	Case 90	2N6487	TO-220
MJE2010	Case 199	BD244	TO-220
MJE2011	Case 199	BD244A	TO-220
MJE2020	Case 199	BD243	TO-220
MJE2021	Case 199	BD243A	TO-220
MJE2050	Case 199	40979	TO-220
		RCA1C10	TO-220
MJE2090	Case 199	RCA8203A	TO-220
		BDX34A	TO-220
MJE2091	Case 199	RCA8203A	TO-220
		BDX34A	TO-220
MJE2092	Case 199	RCA8203B	TO-220
		BDX34B	TO-220
MJE2093	Case 199	RCA8203B	TO-220
		BDX34B	TO-220
MJE2100	Case 199	2N6387	TO-220
		BDX33A	TO-220
MJE2101	Case 199	2N6387	TO-220
		BDX33A	TO-220
MJE2102	Case 199	2N6388	TO-220
		BDX33B	TO-220
MJE2103	Case 199	2N6388	TO-220
		BDX33B	TO-220
MJE2160	Case 90	TA8863B	TO-220
MJE2360	Case 199	TA8863E	TO-220
MJE2361	Case 199	TA8863A	TO-220
MJE2370	Case 199	2N6109	TO-220
		BD240	TO-220
MJE2371	Case 199	2N6107	TO-220
		BD240A	TO-220
MJE2480	Case 199	2N6290	TO-220
		BD243	TO-220
MJE2481	Case 199	2N6292	TO-220
		BD243A	TO-220
MJE2482	Case 199	2N6290	TO-220
		BD243	TO-220
MJE2483	Case 199	2N6292	TO-220
		BD243A	TO-220
MJE2490	Case 199	2N6109	TO-220
		BD244	TO-220
MJE2491	Case 199	2N6107	TO-220
		BD244A	TO-220
MJE2520	Case 199	2N6290	TO-220
		BD239	TO-220
MJE2521	Case 199	2N6292	TO-220
		BD239A	TO-220
MJE2522	Case 199	2N6290	TO-220
		BD241	TO-220
MJE2523	Case 199	2N6292	TO-220
		BD241A	TO-220
MJE2801	Case 90	2N6290	TO-220
		2N6487	TO-220
MJE2801K	Case 199	2N6487	TO-220
MJE2901	Case 90	2N6107	TO-220
		2N6490	TO-220
MJE2901K	Case 199	2N6490	TO-220
MJE2955	Case 90	2N6490	TO-220
		40878	TO-220
MJE2955K	Case 199	2N6490	TO-220
		40878	TO-220
MJE3054	Case 199	RCA3054	TO-220
MJE3055	Case 90	RCA3055	TO-220
MJE3055K	Case 199	RCA3055	TO-220
MJE3370	Case 199	BD242	TO-220
MJE3371	Case 90	40980	TO-220
		RCA1C11	TO-220
MJE3439	TO-126	RCP111D	TO-220
MJE3740	Case 199	2N6107	TO-220
MJE3741	Case 199	2N6107	TO-220
MJE4918	Case 199	BD240	TO-220
MJE4919	Case 199	BD240A	TO-220
MJE4920	Case 199	BD240B	TO-220
MJE4921	Case 199	BD239	TO-220
MJE4922	Case 199	BD239A	TO-220
MJE4923	Case 199	BD239B	TO-220
MJE5655	Case 199	TA8863J	TO-220
MJE5656	Case 199	TA8863F	TO-220
MJE5657	Case 199	TA8863E	TO-220
MJE5974	Case 199	2N6489	TO-220
MJE5975	Case 199	2N6490	TO-220
MJE5976	Case 199	2N6491	TO-220
MJE5977	Case 199	2N6486	TO-220
MJE5978	Case 199	2N6487	TO-220
MJE5979	Case 199	2N6488	TO-220
MJE5980	Case 199	2N6489	TO-220
MJE5981	Case 199	2N6490	TO-220
MJE5982	Case 199	2N6491	TO-220
MJE5983	Case 199	2N6486	TO-220
MJE5984	Case 199	2N6487	TO-220
MJE5985	Case 199	2N6488	TO-220
MJE6040	Case 90	RCA125	TO-220
		BDX34A	TO-220
MJE6041	Case 90	RCA125	TO-220
		BDX34B	TO-220
MJE6042	Case 90	RCA126	TO-220
		BDX34C	TO-220
MJE6043	Case 90	2N6387	TO-220
		BDX33A	TO-220
MJE6044	Case 90	2N6530	TO-220
		BDX33B	TO-220
MJE6045	Case 90	RCA122	TO-220
		BDX33C	TO-220
MM3005	TO-39	40635	TO-39
		RCA1A06	TO-39
MM4000	TO-39	BFT28	TO-39
MM4001	TO-39	BFT28A	TO-39
MM4002	TO-39	BFT28B	TO-39
MM4003	TO-39	BFT28C	TO-39
MM5005	TO-39	40634	TO-39
		RCA1A05	TO-39
MPSU01	Case 152	RCP705	TO-202

Power Devices Cross-Reference Guide

(Industry Type to Equivalent RCA Type)

POWER TRANSISTORS (CONT'D)

Industry Type	Package	RCA Type	Package
MPSU02	Case 152	RCP701B	TO-202
MPSU05	Case 152	RCP701B	TO-202
MPSU06	Case 152	RCP701C	TO-202
MPSU07	Case 152	RCP701D	TO-202
MPSU10	Case 152	RCP111D	TO-202
MPSU51	Case 152	RCP704	TO-202
MPSU52	Case 152	RCP700A	TO-202
MPSU55	Case 152	RCP700B	TO-202
MPSU56	Case 152	RCP700C	TO-202
MPSU57	Case 152	RCP700D	TO-202
NSD102	TO-202	RCP701B	TO-202
NSD103	TO-202	RCP701B	TO-202
NSD104	TO-202	RCP701C	TO-202
NSD105	TO-202	RCP701C	TO-202
NSD106	TO-202	RCP701D	TO-202
NSD131	TO-202	RCP113B	TO-202
NSD132	TO-202	RCP111B	TO-202
NSD133	TO-202	RCP113C	TO-202
NSD134	TO-202	RCP111C	TO-202
NSD135	TO-202	RCP111D	TO-202
NSD202	TO-202	RCP700B	TO-202
NSD203	TO-202	RCP700B	TO-202
NSD204	TO-202	RCP700C	TO-202
NSD205	TO-202	RCP700C	TO-202
NSD206	TO-202	RCP700D	TO-202
SDT410	TO-3	RCA410	TO-3
SDT411	TO-3	RCA411	TO-3
SDT413	TO-3	RCA413	TO-3
SDT423	TO-3	RCA423	TO-3
SDT431	TO-3	RCA431	TO-3
SDT6901	TO-66	2N6078	TO-66
SDT6902	TO-66	2N6078	TO-66
SDT6903	TO-66	2N6078	TO-66
SDT6904	TO-66	2N6078	TO-66
SDT6905	TO-66	2N6078	TO-66
SDT6906	TO-66	2N6078	TO-66
SDT6907	TO-66	2N6078	TO-66
SDT6908	TO-66	2N6078	TO-66
SDT7601	TO-3	2N5039	TO-3
SDT7602	TO-3	2N5039	TO-3
SDT7603	TO-3	2N5038	TO-3
SDT7604	TO-3	2N6496	TO-3
SDT7605	TO-3	2N6249	TO-3
SDT7607	TO-3	2N5039	TO-3
SDT7608	TO-3	2N5039	TO-3
SDT7609	TO-3	2N5038	TO-3
SDT7610	TO-3	2N6354	TO-3
SDT7731	TO-3	2N6470	TO-3
SDT7732	TO-3	2N6471	TO-3
SDT7733	TO-3	2N6472	TO-3
SDT8002	TO-63	2N3266	TO-63
SDT8003	TO-63	2N3265	TO-63

Industry Type	Package	RCA Type	Package
SDT8012	TO-63	2N3266	TO-63
SDT8013	TO-63	2N3265	TO-63
SDT8015	TO-63	2N3266	TO-63
SDT8016	TO-63	2N3265	TO-63
SDT8105	Radial	2N3264	Radial
SDT8106	Radial	2N3263	Radial
SDT8112	Radial	2N3264	Radial
SDT8113	Radial	2N3263	Radial
SDT8301	TO-63	2N3266	TO-63
SDT8302	TO-63	2N3265	TO-63
SDT8303	TO-63	2N3266	TO-63
SDT8304	TO-63	2N3265	TO-63
SDT9201	TO-3	2N3055	TO-3
SDT9202	TO-3	2N6254	TO-3
SDT9203	TO-3	2N4348	TO-3
SDT9204	TO-3	2N4348	TO-3
SDT9205	TO-3	2N3055	TO-3
SDT9206	TO-3	2N3055	TO-3
SDT9207	TO-3	2N6254	TO-3
SDT9208	TO-3	2N4348	TO-3
SDT9209	TO-3	2N4348	TO-3
SDT9210	TO-3	2N6253	TO-3
SDT9701	TO-3	2N6258	TO-3
SDT9702	TO-3	2N4348	TO-3
SDT9703	TO-3	2N4348	TO-3
SDT9704	TO-3	2N6254	TO-3
SDT9705	TO-3	2N4348	TO-3
SDT9706	TO-3	2N4348	TO-3
SDT9707	TO-3	2N3055	TO-3
SDT9801	TO-3	2N6254	TO-3
SDT9802	TO-3	2N6254	TO-3
SDT9803	TO-3	2N6254	TO-3
SDT9804	TO-3	2N3773	TO-3
SE9300	TO-220	RCA120	TO-220
SE9301	TO-220	RCA121	TO-220
SE9302	TO-220	RCA122	TO-220
SE9303	TO-3	2N6384	TO-3
SE9304	TO-3	2N6385	TO-3
SPC410	TO-3	RCA410	TO-3
SPC411	TO-3	RCA411	TO-3
SPC413	TO-3	RCA413	TO-3
SPC423	TO-3	RCA423	TO-3
SPC431	TO-3	RCA431	TO-3
STS410	TO-3	RCA410	TO-3
STS411	TO-3	RCA411	TO-3
STS413	TO-3	RCA413	TO-3
STS423	TO-3	RCA423	TO-3
STS431	TO-3	RCA431	TO-3
T1482	TO-39	40311	TO-39
T1484	TO-39	2N697	TO-39
T1492	TO-39	40407	TO-39
T1493	TO-39	2N1613	TO-39
TIP29	TO-220	BD239	TO-220
		RCA29	TO-220
		TIP29	TO-220
TIP29A	TO-220	BD239A	TO-220
		RCA29A	TO-220
		TIP29A	TO-220
TIP29B	TO-220	BD239B	TO-220
		RCA29B	TO-220
		TIP29B	TO-220

Industry Type	Package	RCA Type	Package
TIP29C	TO-220	BD239C	TO-220
		RCA29C	TO-220
		TIP29C	TO-220
TIP30	TO-220	BD240	TO-220
		RCA30	TO-220
		TIP30	TO-220
TIP30A	TO-220	BD240A	TO-220
		RCA30A	TO-220
		TIP30A	TO-220
TIP30B	TO-220	BD240B	TO-220
		RCA30B	TO-220
		TIP30B	TO-220
TIP30C	TO-220	BD240C	TO-220
		RCA30C	TO-220
		TIP30C	TO-220
TIP31	TO-220	BD241	TO-220
		RCA31	TO-220
		TIP31	TO-220
TIP31A	TO-220	BD241A	TO-220
		RCA31A	TO-220
		TIP31A	TO-220
TIP31B	TO-220	BD241B	TO-220
		RCA31B	TO-220
		TIP31B	TO-220
TIP31C	TO-220	BD241C	TO-220
		RCA31C	TO-220
		TIP31C	TO-220
TIP32	TO-220	BD242	TO-220
		RCA32	TO-220
		TIP32	TO-220
TIP32A	TO-220	BD242A	TO-220
		RCA32A	TO-220
		TIP32A	TO-220
TIP32B	TO-220	BD242B	TO-220
		RCA32B	TO-220
		TIP32B	TO-220
TIP32C	TO-220	BD242C	TO-220
		RCA32C	TO-220
		TIP32C	TO-220
TIP33	TO-3P	2N6486	TO-220
TIP33A	TO-3P	2N6487	TO-220
TIP33B	TO-3P	2N6488	TO-220
TIP34	TO-3P	2N6489	TO-220
TIP34A	TO-3P	2N6490	TO-220
TIP34B	TO-3P	2N6491	TO-220
TIP41	TO-220	BD243	TO-220
		RCA41	TO-220
		TIP41	TO-220
TIP41A	TO-220	BD243A	TO-220
		RCA41A	TO-220
		TIP41A	TO-220
TIP41B	TO-220	BD243B	TO-220
		RCA41B	TO-220
		TIP41B	TO-220
TIP41C	TO-220	BD243C	TO-220
		RCA41C	TO-220
		TIP41C	TO-220
TIP42	TO-220	BD244	TO-220
		RCA42	TO-220
		TIP42	TO-220
TIP42A	TO-220	BD244A	TO-220
		RCA42A	TO-220
		TIP42A	TO-220

POWER TRANSISTORS (CONT'D)

Industry Type	Package	RCA Type	Package
TIP42B	TO-220	BD244B	TO-220
		RCA42B	TO-220
		TIP42B	TO-220
TIP42C	TO-220	BD244C	TO-220
		RCA42C	TO-220
		TIP42C	TO-220
TIP110	TO-220	BDX33A	TO-220
TIP111	TO-220	BDX33B	TO-220
TIP112	TO-220	BDX33C	TO-220
TIP115	TO-220	BDX34A	TO-220
TIP116	TO-220	BDX34B	TO-220
TIP117	TO-220	BDX34C	TO-220
TIP120	TO-220	BDX33A	TO-220
		RCA120	TO-220
		TIP120	TO-220
TIP121	TO-220	BDX33B	TO-220
		RCA121	TO-220
		TIP121	TO-220
TIP122	TO-220	BDX33C	TO-220
		RCA122	TO-220
		TIP122	TO-220
TIP125	TO-220	BDX34A	TO-220
		RCA125	TO-220
		TIP125	TO-220
TIP126	TO-220	BDX34B	TO-220
		RCA126	TO-220
		TIP126	TO-220
TIP127	TO-220	BDX34C	TO-220
		TIP127	TO-220
TIP140	TO-218	2N6387	TO-220
TIP141	TO-218	2N6530	TO-220
TIP142	TO-218	2N6531	TO-220
TIP145	TO-218	RCA8203A	TO-220
TIP146	TO-218	RCA8203B	TO-220
TIP147	TO-218	RCA8203B	TO-220
TIP525	TO-3	BUX27A	TO-3
TIP531	TO-3	2N6250	TO-3
TIP535	TO-3	BUX17A	TO-3
TIP538	TO-3	2N6250	TO-3
TIP539	TO-3	2N6250	TO-3
TIP544	TO-3	2N6248	TO-3
TIP546	TO-3	2N6469	TO-3
TIP640	TO-3	2N6384	TO-3
TIP641	TO-3	2N6385	TO-3
TIP642	TO-3	2N6385	TO-3
TIP645	TO-3	RCA8350	TO-3
TIP646	TO-3	RCA8350A	TO-3
TIP647	TO-3	RCA8350B	TO-3
TIP2955	TO-3P	2N6490	TO-220
		40878	TO-220
TIP3054	TO-220	RCA3054	TO-220
TIP3055	TO-3P	RCA3055	TO-220
TIP5530	TO-3P	2N6099	TO-220
TS2218	TO-39	2N1613	TO-39
TS2219	TO-39	2N1711	TO-39
TS2904	TO-39	40406	TO-39

SILICON CONTROLLED RECTIFIERS

Industry Type	Package	RCA Type	Package
2N1842	TO-48	2N1842A	TO-48
2N1843	TO-48	2N1843A	TO-48
2N1844	TO-48	2N1844A	TO-48
2N1845	TO-48	2N1845A	TO-48
2N1846	TO-48	2N1846A	TO-48
2N1847	TO-48	2N1847A	TO-48
2N1848	TO-48	2N1848A	TO-48
2N1849	TO-48	2N1849A	TO-48
2N1850	TO-48	2N1850A	TO-48
2N4441	Case 90	S122F	TO-220
2N4442	Case 90	S122B	TO-220
2N4443	Case 90	S122D	TO-220
2N4444	Case 90	S122M	TO-220
2N6236	TO-126	S2060Y	TO-220
2N6237	TO-126	S2060F	TO-220
2N6238	TO-126	S2060A	TO-220
2N6239	TO-126	S2060B	TO-220
2N6240	TO-126	S2060D	TO-220
2N6241	TO-126	S2060M	TO-220
10RC10A	TO-48	2N1844A	TO-48
10RC10AS24	TO-48	2N3650	TO-48
10RC20A	TO-48	2N1846A	TO-48
10RC20AS24	TO-48	2N3650	TO-48
10RC30A	TO-48	2N1848A	TO-48
10RC30AS24	TO-48	2N3651	TO-48
10RC40A	TO-48	2N1849A	TO-48
10RC40AS24	TO-48	2N3652	TO-48
10RC50A	TO-48	2N1850A	TO-48
10RC50AS24	TO-48	S7410M	TO-48
10RC60AS24	TO-48	S7410M	TO-48
16RC10A	TO-48	2N683	TO-48
16RC10AS24	TO-48	2N3650	TO-48
16RC20A	TO-48	2N685	TO-48
16RC20AS24	TO-48	2N3651	TO-48
16RC30A	TO-48	2N687	TO-48
16RC30AS24	TO-48	2N3652	TO-48
16RC40A	TO-48	2N688	TO-48
16RC40AS24	TO-48	2N3653	TO-48
16RC50A	TO-48	2N689	TO-48
16RC50AS24	TO-48	S7410M	TO-48
16RC60A	TO-48	2N690	TO-48
16RC60AS24	TO-48	S7410M	TO-48
BstB0106B	MU22	S2061A	TO-220
BstB0113B	MU22	S2061B	TO-220
BstB0126B	MU22	S2061D	TO-220
BstB0133B	MU22	S2061E	TO-220
BstB0140B	MU22	S2061M	TO-220
BstB0106BS4	MU22	S2061A	TO-220
BstB0113BS4	MU22	S2061B	TO-220
BstB0126BS4	MU22	S2061D	TO-220
BstB0133BS4	MU22	S2061E	TO-220
BstB0106BS5	MU22	S2061A	TO-220
BstB0113BS5	MU22	S2061B	TO-220
BstB0126BS5	MU22	S2061D	TO-220
BstB0133BS5	MU22	S2061E	TO-220
BstB0106C	MU22	S2062A	TO-220
BstB0113C	MU22	S2062B	TO-220
BstB0126C	MU22	S2062D	TO-220
BstB0133C	MU22	S2062E	TO-220
BstB0140C	MU22	S2062M	TO-220
BstB0106CS4	MU22	S2062A	TO-220
BstB0113CS4	MU22	S2062B	TO-220
BstB0126CS4	MU22	S2062D	TO-220
BstB0133CS4	MU22	S2062E	TO-220
BstB0140CS4	MU22	S2062M	TO-220
BstB0106D	MU22	S2062A	TO-220
BstB0113D	MU22	S2062B	TO-220
BstB0126D	MU22	S2062D	TO-220
BstB0133D	MU22	S2062E	TO-220
BstB0140D	MU22	S2062M	TO-220
BstB0106E	MU22	S2062A	TO-220
BstB0113E	MU22	S2062B	TO-220
BstB0126E	MU22	S2062D	TO-220
BstB0133E	MU22	S2062E	TO-220
BstB0140E	MU22	S2062M	TO-220
BstB0106F	MU22	S2062A	TO-220
BstB0113F	MU22	S2062B	TO-220
BstB0126F	MU22	S2062D	TO-220
BstB0133F	MU22	S2062E	TO-220
BstB0140F	MU22	S2062M	TO-220
BstB0206B	MU23	S2061A	TO-220
BstB0213B	MU23	S2061B	TO-220
BstB0226B	MU23	S2061D	TO-220
BstB0233B	MU23	S2061E	TO-220
BstB0206BS4	MU23	S2061A	TO-220
BstB0213BS4	MU23	S2061B	TO-220
BstB0226BS4	MU23	S2061D	TO-220
BstB0233BS4	MU23	S2061E	TO-220
BstB0206BS5	MU23	S2061A	TO-220
BstB0213BS5	MU23	S2061B	TO-220
BstB0226BS5	MU23	S2061D	TO-220
BstB0233BS5	MU23	S2061E	TO-220
BstB0206C	MU23	S2062A	TO-220
BstB0213C	MU23	S2062B	TO-220
BstB0233C	MU23	S2062E	TO-220
BstB0240C	MU23	S2062M	TO-220
BstB0206CS4	MU23	S2062A	TO-220
BstB0213CS4	MU23	S2062B	TO-220
BstB0226CS4	MU23	S2062D	TO-220
BstB0233CS4	MU23	S2062E	TO-220
BstB0240CS4	MU23	S2062M	TO-220
BstB0206D	MU23	S2062A	TO-220
BstB0213D	MU23	S2062B	TO-220
BstB0226D	MU23	S2062D	TO-220
BstB0233D	MU23	S2062E	TO-220
BstB0240D	MU23	S2062M	TO-220
BstB0206E	MU23	S2062A	TO-220
BstB0113E	MU23	S2062B	TO-220
BstB0226E	MU23	S2062D	TO-220
BstB0233E	MU23	S2062E	TO-220
BstB0240E	MU23	S2062M	TO-220
BstB0206F	MU23	S2062A	TO-220
BstB0213F	MU23	S2062B	TO-220
BstB0226F	MU23	S2062D	TO-220
BstB0233F	MU23	S2062E	TO-220
BstB0240F	MU23	S2062M	TO-220
BstC0313	SC88	2N1846	TO-48
BstC0326	SC88	2N1849	TO-48
BstC0313S6	SC88	2N1846	TO-48
BstC0326S6	SC88	2N1849	TO-48
BstC0506E	TO-66	2N3228	TO-66
BstC0513E	TO-66	2N3228	TO-66
BstC0526E	TO-66	2N3525	TO-66
BstC0533E	TO-66	2N4101	TO-66
BstC0540E	TO-66	2N4101	TO-66
BstC0546E	TO-66	2N4101	TO-66
BstC0506F	TO-66	2N3228	TO-66
BstC0513F	TO-66	2N3228	TO-66
BstC0526F	TO-66	2N3525	TO-66
BstC0533F	TO-66	2N4101	TO-66

Power Devices Cross-Reference Guide

(Industry Type to Equivalent RCA Type)

SILICON CONTROLLED RECTIFIERS (CONT'D)

Industry Type	Package	RCA Type	Package
BstC0540F	TO-66	2N4101	TO-66
BstC0546F	TO-66	2N4101	TO-66
BstC0506G	TO-66	2N3228	TO-66
BstC0503G	TO-66	2N3228	TO-66
BstC0526G	TO-66	2N3525	TO-66
BstC0533G	TO-66	2N4101	TO-66
BstC0540G	TO-66	2N4101	TO-66
BstC0546G	TO-66	2N4101	TO-66
BstC0506H	TO-66	2N3228	TO-66
BstC0513H	TO-66	2N3228	TO-66
BstC0526H	TO-66	2N3525	TO-66
BstC0533H	TO-66	2N4101	TO-66
BstC0540H	TO-66	2N4101	TO-66
BstC0546H	TO-66	2N4101	TO-66
BT102-300R	TO-220	S2800C	TO-220
BT102-500R	TO-220	S2800E	TO-220
BTW30-300	TO-48	2N3657	TO-48
BTW30-400	TO-48	2N3658	TO-48
BTW30-500	TO-48	S7432M	TO-48
BTW30-600	TO-48	S7432M	TO-48
BTW31-300	TO-48	2N3657	TO-48
BTW31-400	TO-48	2N3658	TO-48
BTW31-500	TO-48	S7412M	TO-48
BTW31-600	TO-48	S7412M	TO-48
BTW47-600	TO-48	S6410M	stud
BTW92-600	TO-48	2N3899	stud
BTW92-800	TO-48	S6410N	stud
BTY87-400	TO-48	S6210D	stud
BTY87-400R	TO-48	2N3898	stud
BTY87-500	TO-48	S6210M	stud
BTY87-500R	TO-48	2N3899	stud
BTY87-600	TO-48	S6210M	stud
BTY87-600R	TO-48	2N3899	stud
BTY87-800R	TO-48	S6410N	stud
BTY91-400	TO-48	S6210D	stud
BTY91-400R	TO-48	2N3898	stud
BTY91-500	TO-48	S6210M	stud
BTY91-500R	TO-48	2N3899	stud
BTY91-600	TO-48	S6210M	stud
BTY91-600R	TO-48	2N3899	stud
BTY91-800R	TO-48	S6410N	stud
C20A	stud	S6210A	stud
C20B	stud	S6210B	stud
C20C	stud	S6210C	stud
C20D	stud	S6210D	stud
C20F	stud	S6210A	stud
C20U	stud	S6210A	stud
C22A	press-fit	S6200A	press-fit
C22B	press-fit	S6200B	press-fit
C22C	press-fit	S6200C	press-fit
C22D	press-fit	S6200D	press-fit
C22F	press-fit	S6200A	press-fit
C22U	press-fit	S6200A	press-fit
C30A	stud	2N3896	stud
C30B	stud	2N3897	stud
C30C	stud	2N3898	stud
C30D	stud	2N3898	stud
C30P	stud	2N3896	stud
C30U	stud	2N3896	stud
C31A	stud	2N3896	stud
C31B	stud	2N3897	stud
C31C	stud	2N3898	stud

Industry Type	Package	RCA Type	Package
C31D	stud	2N3898	stud
C31P	stud	2N3896	stud
C31U	stud	2N3896	stud
C32A	press-fit	2N3870	press-fit
C32B	press-fit	2N3871	press-fit
C32C	press-fit	2N3872	press-fit
C32D	press-fit	2N3872	press-fit
C32F	press-fit	2N3870	press-fit
C32U	press-fit	2N3870	press-fit
C33A	press-fit	2N3870	press-fit
C33B	press-fit	2N3871	press-fit
C33C	press-fit	2N3872	press-fit
C33D	press-fit	2N3872	press-fit
C33F	press-fit	2N3870	press-fit
C33U	press-fit	2N3870	press-fit
C34A2	stud	2N3650	TO-48
C34B2	stud	2N3651	TO-48
C34C2	stud	2N3652	TO-48
C34D2	stud	2N3653	TO-48
C34E2	stud	S7410M	TO-48
C34F2	stud	2N3650	TO-48
C35A	TO-48	2N683	TO-48
		2N3896	stud
C35B	TO-48	2N685	TO-48
		2N3897	stud
C35C	TO-48	2N687	TO-48
		2N3898	stud
C35D	TO-48	2N688	TO-48
		2N3898	stud
C35E	TO-48	2N689	TO-48
		2N3899	stud
C35F	TO-48	2N682	TO-48
		2N3896	stud
C35G	TO-48	2N684	TO-48
		2N3897	stud
C35H	TO-48	2N686	TO-48
		2N3898	stud
C35M	TO-48	2N690	TO-48
		2N3899	stud
C35U	TO-48	2N681	TO-48
		2N3896	stud
C36A	TO-48	2N1844A	TO-48
C36B	TO-48	2N1846A	TO-48
C36C	TO-48	2N1848A	TO-48
C36D	TO-48	2N1849A	TO-48
C36E	TO-48	2N1850A	TO-48
C36F	TO-48	2N1843A	TO-48
C36G	TO-48	2N1845A	TO-48
C36H	TO-48	2N1847A	TO-48
C36U	TO-48	2N1842A	TO-48
C38A	TO-48	2N683	TO-48
C38B	TO-48	2N685	TO-48
C38C	TO-48	2N687	TO-48
C38D	TO-48	2N688	TO-48
C38E	TO-48	2N689	TO-48
C38F	TO-48	2N682	TO-48
C38G	TO-48	2N684	TO-48
C38M	TO-48	2N686	TO-48
C38U	TO-48	2N681	TO-48
C40A	TO-48	2N3650	TO-48
C40B	TO-48	2N3651	TO-48
C40C	TO-48	2N3652	TO-48

Industry Type	Package	RCA Type	Package
C40D	TO-48	2N3653	TO-48
C40E	TO-48	S7410M	TO-48
C40F	TO-48	2N3650	TO-48
C40G	TO-48	2N3651	TO-48
C40H	TO-48	2N3652	TO-48
C40U	TO-48	2N3650	TO-48
C45A	TO-49	TAS8612A	stud
C45B	TO-49	TAS8612B	stud
C45C	TO-49	TAS8612D	stud
C45D	TO-49	TAS8612D	stud
C45E	TO-49	TAS8612M	stud
C45F	TO-49	TAS8612A	stud
C45G	TO-49	TAS8612B	stud
C45H	TO-49	TAS8612D	stud
C45M	TO-49	TAS8612M	stud
C45N	TO-49	TAS8612N	stud
C45U	TO-49	TAS8612A	stud
C106A	TO-202	C106A	TO-202
		S106A	TO-202
C106B	TO-202	C106B	TO-202
		S106B	TO-202
C106C	TO-202	C106C	TO-202
		S106C	TO-202
C106D	TO-202	C106D	TO-202
		S106D	TO-202
C106F	TO-202	C106F	TO-202
		S106F	TO-202
C106Q	TO-202	C106Q	TO-202
		S106Q	TO-202
C106Y	TO-202	C106Y	TO-202
		S106Y	TO-202
C107A	TO-202	C107A	TO-202
		S107A	TO-202
C107B	TO-202	C107B	TO-202
		S107B	TO-202
C107C	TO-202	C107C	TO-202
		S107C	TO-202
C107D	TO-202	C107D	TO-202
		S107D	TO-202
C107F	TO-202	C107F	TO-202
		S107F	TO-202
C107Q	TO-202	C107Q	TO-202
		S107Q	TO-202
C107Y	TO-202	C107Y	TO-202
		S107Y	TO-202
C122A	TO-220	S122A	TO-220
		S2800A	TO-220
C122B	TO-220	S122B	TO-220
		S2800B	TO-220
C122C	TO-220	S122C	TO-220
		S2800C	TO-220
C122D	TO-220	S122D	TO-220
		S2800D	TO-220
C122E	TO-220	S122E	TO-220
		S2800E	TO-220
C122F	TO-220	S122F	TO-220
		S2800F	TO-220
C122G	TO-220	S122G	TO-220
		S2800G	TO-220
C122M	TO-220	S122M	TO-220
		S2800M	TO-220
C122Y	TO-220	S122A	TO-220
		S2800A	TO-220

SILICON CONTROLLED RECTIFIERS (CONT'D)

Industry Type	Package	RCA Type	Package
C137E	TO-48	2N3899	stud
C137M	TO-48	2N3899	stud
C137N	TO-48	S6410N	stud
C137S	TO-48	S6410N	stud
C140A	TO-48	2N3650	TO-48
C140B	TO-48	2N3651	TO-48
C140C	TO-48	2N3652	TO-48
C140D	TO-48	2N3653	TO-48
C140F	TO-48	2N3654	TO-48
C141A	TO-48	2N3655	TO-48
C141B	TO-48	2N3656	TO-48
C141C	TO-48	2N3657	TO-48
C141D	TO-48	2N3658	TO-48
C141F	TO-48	2N3654	TO-48
C220A	stud	S6210A	stud
C220A2	ISOstud	S6220A	ISOstud
C220B	stud	S6210B	stud
C220B2	ISOstud	S6220B	ISOstud
C220C	stud	S6210C	stud
C220C2	ISOstud	S6220C	ISOstud
C220D	stud	S6210D	stud
C220D2	ISOstud	S6220D	ISOstud
C220E	stud	S6210M	ISOstud
C220E2	ISOstud	S6220M	ISOstud
C220F	stud	S6210A	stud
C220F2	ISOstud	S6220A	ISOstud
C220U	stud	S6210A	stud
C220U2	ISOstud	S6220A	ISOstud
C222A	press-fit	S6200A	press-fit
C222B	press-fit	S6200D	press-fit
C222C	press-fit	S6200D	press-fit
C222D	press-fit	S6200D	press-fit
C222E	press-fit	S6200M	press-fit
C222F	press-fit	S6200A	press-fit
C222U	press-fit	S6200A	press-fit
CS5-2T	TO-66	2N3228	TO-66
CS5-4T	TO-66	2N3525	TO-66
CS5-5.5T	TO-66	2N4101	TO-66
CS10-02M	press-fit	S6200A	press-fit
CS10-02N	stud	S6210A	stud
CS10-05M	press-fit	S6200A	press-fit
CS10-05N	stud	S6210A	stud
CS10-1M	press-fit	S6200A	press-fit
CS10-1N	stud	S6210A	stud
CS10-2M	press-fit	S6200B	press-fit
CS10-2N	stud	S6210B	stud
CS10-4M	press-fit	S6200D	press-fit
CS10-4N	stud	S6210D	stud
CS10-6M	press-fit	S6200M	press-fit
CS10-6N	stud	S6210D	stud
CS20-05M	press-fit	S6200A	press-fit
CS20-05N	stud	S6210A	stud
CS20-1M	press-fit	S6200A	press-fit
CS20-1N	stud	S6210A	stud
CS20-2M	press-fit	S6200B	press-fit
CS20-2N	stud	S6210B	stud
CS20-4M	press-fit	S6200D	press-fit
CS20-4N	stud	S6210D	stud
CS20-6M	press-fit	S6200M	press-fit
CS20-6N	stud	S6210M	stud
CS35-02M	press-fit	2N3870	press-fit
CS35-02N	stud	2N3896	stud
CS35-05M	press-fit	2N3870	press-fit

Industry Type	Package	RCA Type	Package
CS35-05N	stud	2N3896	stud
CS35-1M	press-fit	2N3870	press-fit
CS35-1N	stud	2N3896	stud
CS35-2M	press-fit	2N3871	press-fit
CS35-2N	stud	2N3897	stud
CS35-4M	press-fit	2N3872	press-fit
CS35-4N	stud	2N3898	stud
CS35-6M	press-fit	2N3873	press-fit
CS35-6N	stud	2N3899	stud
CS0602602	MU22	S108B	TO-202
CS0602604	MU22	S107B	TO-202
CS0604602	MU22	S108D	TO-202
CS0604604	MU22	S107D	TO-202
CS0606602	MU22	S108M	TO-202
CS102603	MU23	S108B	TO-202
CS104603	MU23	S108D	TO-202
CS106603	MU23	S108E	TO-202
CS108603	MU23	S108M	TO-202
CS302D02	TO-220	S2062B	TO-220
CS304D02	TO-220	S2062D	TO-220
CS305D02	TO-220	S2062E	TO-220
CS306D02	TO-220	S2062M	TO-220
EC106A1	TO-202	S106A	TO-202
EC106B1	TO-202	S106B	TO-202
EC106M1	TO-202	S106M	TO-202
EC107A1	TO-202	S107A	TO-202
EC107B1	TO-202	S107B	TO-202
EC107M1	TO-202	S107M	TO-202
IR140A	TO-48	2N3650	TO-48
IR140B	TO-48	2N3651	TO-48
IR140C	TO-48	2N3652	TO-48
IR140D	TO-48	2N3653	TO-48
IR140F	TO-48	2N3654	TO-48
IR141A	TO-48	2N3655	TO-48
IR141B	TO-48	2N3656	TO-48
IR141C	TO-48	2N3657	TO-48
IR141D	TO-48	2N3658	TO-48
IR141F	TO-48	2N3654	TO-48
MCR106-1	Case 77	S2061Y	TO-220
MCR106-2	Case 77	S2061F	TO-220
MCR106-3	Case 77	S2061A	TO-220
MCR106-4	Case 77	S2061B	TO-220
MCR106-5	Case 77	S2061C	TO-220
MCR106-6	Case 77	S2061D	TO-220
MCR106-7	Case 77	S2061E	TO-220
MCR106-8	Case 77	S2061M	TO-220
MCR107-1	Case 77	S2062Y	TO-220
MCR107-2	Case 77	S2062F	TO-220
MCR107-3	Case 77	S2062A	TO-220
MCR107-4	Case 77	S2062B	TO-220
MCR107-5	Case 77	S2062C	TO-220
MCR107-6	Case 77	S2062D	TO-220
MCR107-7	Case 77	S2062E	TO-220
MCR406-1	Case 90	S2060Y	TO-220
MCR406-2	Case 90	S2060F	TO-220
MCR406-3	Case 90	S2060A	TO-220
MCR406-4	Case 90	S2060B	TO-220
MCR407-1	Case 90	S2061Y	TO-220
MCR407-2	Case 90	S2061F	TO-220
MCR407-3	Case 90	S2061A	TO-220
MCR407-4	Case 90	S2061B	TO-220
MCR1718-5	TO-48	2N3653	TO-48
MCR1718-6	TO-48	2N3653	TO-48

Industry Type	Package	RCA Type	Package
MCR1718-7	TO-48	S7410M	TO-48
MCR1718-8	TO-48	S7410M	TO-48
MCR3000-1	Case 90	S122F	TO-220
MCR3000-2	Case 90	S122F	TO-220
MCR3000-3	Case 90	S122A	TO-220
MCR3000-4	Case 90	S122B	TO-220
MCR3000-5	Case 90	S122C	TO-220
MCR3000-6	Case 90	S122D	TO-220
MCR3000-7	Case 90	S122E	TO-220
MCR3000-8	Case 90	S122M	TO-220
MCR3818-1	press-fit	S6200A	press-fit
MCR3818-3	press-fit	S6200A	press-fit
MCR3818-5	press-fit	S6200D	press-fit
MCR3818-7	press-fit	S6200M	press-fit
MCR3835-1	press-fit	2N3870	press-fit
MCR3835-2	press-fit	2N3870	press-fit
MCR3835-3	press-fit	2N3870	press-fit
MCR3835-4	press-fit	2N3871	press-fit
MCR3835-5	press-fit	2N3872	press-fit
MCR3835-6	press-fit	2N3872	press-fit
MCR3835-7	press-fit	2N3873	press-fit
MCR3835-8	press-fit	2N3873	press-fit
MCR3918-1	stud	S6210A	stud
MCR3518-3	stud	S6210A	stud
MCR3918-5	stud	S6210D	stud
MCR3918-7	stud	S6210M	stud
MCR3935-1	stud	2N3896	stud
MCR3936-2	stud	2N3896	stud
MCR9935-3	stud	2N3896	stud
MCR3935-4	stud	2N3897	stud
MCR3935-5	stud	2N3898	stud
MCR3935-6	stud	2N3898	stud
MCR3935-7	stud	2N3899	stud
MCR3935-8	stud	2N3899	stud
NL-C35A	TO-48	2N683	TO-48
NL-C35B	TO-48	2N685	TO-48
NL-C35C	TO-48	2N687	TO-48
NL-C35D	TO-48	2N688	TO-48
NL-C35E	TO-48	2N689	TO-48
NL-C35G	TO-48	2N684	TO-48
NL-C35H	TO-48	2N686	TO-48
NL-C35M	TO-48	2N689	TO-48
NL-C36A	TO-48	2N1844A	TO-48
NL-C36B	TO-48	2N1846A	TO-48
NL-C36C	TO-48	2N1848A	TO-48
NL-C36D	TO-48	2N1849A	TO-48
NL-C36E	TO-48	2N1850A	TO-48
NL-C36G	TO-48	2N1845A	TO-48
NL-C36H	TO-48	2N1847A	TO-48
NL-C40A	TO-48	2N3650	TO-48
NL-C40B	TO-48	2N3651	TO-48
NL-C40C	TO-48	2N3652	TO-48
NL-C40D	TO-48	2N3654	TO-48
NL-C40E	TO-48	S7410M	TO-48
NL-C40G	TO-48	2N3651	TO-48
NL-C40H	TO-48	2N3652	TO-48
NL570M	TO-48	2N690	TO-48
PS08	press-fit	S6200A	press-fit
PS18	press-fit	S6200A	press-fit
PS020	press-fit	S6200A	press-fit
PS28	press-fit	S6200B	press-fit
PS035	press-fit	2N3870	press-fit
PS38	press-fit	S6200D	press-fit

Power Devices Cross-Reference Guide

(Industry Type to Equivalent RCA Type)

SILICON CONTROLLED RECTIFIERS (CONT'D)

Industry Type	Package	RCA Type	Package
PS48	press-fit	S6200D	press-fit
PS58	press-fit	S6200M	press-fit
PS68	press-fit	S6200M	press-fit
PS120	press-fit	S6200M	press-fit
PS135	press-fit	2N3870	press-fit
PS220	press-fit	S6200B	press-fit
PS235	press-fit	2N3871	press-fit
PS320	press-fit	S6200D	press-fit
PS335	press-fit	2N3872	press-fit
PS420	press-fit	S6200D	press-fit
PS435	press-fit	2N3872	press-fit
PS520	press-fit	S6200M	press-fit
PS535	press-fit	2N3873	press-fit
PS620	press-fit	S6200M	press-fit
PS635	press-fit	2N3873	press-fit
RTS0202	press-fit	S6200A	press-fit
RTS0205	press-fit	S6200A	press-fit
RTS0210	press-fit	S6200A	press-fit
RTS0220	press-fit	S6200B	press-fit
RTS0230	press-fit	S6200D	press-fit
RTS0240	press-fit	S6200D	press-fit
RTS0250	press-fit	S6200M	press-fit
RTS0260	press-fit	S6200M	press-fit
RTS0502	press-fit	S6200A	press-fit
RTS0505	press-fit	S6200A	press-fit
RTS0510	press-fit	S6200A	press-fit
RTS0520	press-fit	S6200B	press-fit
RTS0530	press-fit	S6200D	press-fit
RTS0540	press-fit	S6200D	press-fit
RTS0550	press-fit	S6200M	press-fit
RTS0602	press-fit	S6200A	press-fit
RTS0605	press-fit	S6200A	press-fit
RTS0610	press-fit	S6200A	press-fit
RTS0620	press-fit	S6200B	press-fit
RTS0630	press-fit	S6200D	press-fit
RTS0640	press-fit	S6200D	press-fit
RTS0650	press-fit	S6200M	press-fit
RTS0660	press-fit	S6200M	press-fit
RTU0102	stud	S6210A	stud
RTU0105	stud	S6210A	stud
RTU0110	stud	S6210A	stud
RTU0120	stud	S6210B	stud
RTU0130	stud	S6210D	stud
RTU0140	stud	S6210D	stud
RTU0150	stud	S6210M	stud
RTU0160	stud	S6210M	stud
RTU0202	stud	2N3896	stud
RTU0205	stud	2N3896	stud
RTU0210	stud	2N3896	stud
RTU0220	stud	2N3897	stud
RTU0230	stud	2N3898	stud
RTU0240	stud	2N3898	stud
RTU0250	stud	S6410N	stud
RTU0260	stud	S6410N	stud
RTU0602	stud	2N3896	stud
RTU0605	stud	2N3896	stud
RTU0610	stud	2N3896	stud
RTU0620	stud	2N3897	stud
RTU0630	stud	2N3898	stud
RTU0640	stud	2N3898	stud
RTU0650	stud	2N3899	stud
RTU0660	stud	2N3899	stud
RTU0705	stud	2N3896	stud
RTU0710	stud	2N3896	stud
RTU0720	stud	2N3897	stud
RTU0730	stud	2N3898	stud
RTU0740	stud	2N3898	stud
RTU0750	stud	2N3899	stud
RTU0760	stud	2N3899	stud
S0525G	press-fit	2N3870	press-fit
S1003RS2	TO-220	S2060A	TO-220
S1003RS3	TO-220	S2061A	TO-220
S1006B	ISOstud	S6220A	ISOstud
S1006G	press-fit	S6200A	press-fit
S1006H	stud	S6210A	stud
S1008B	ISOstud	S6220A	ISOstud
S1008G	press-fit	S6200A	press-fit
S1008H	stud	S6210A	stud
S1010B	ISOstud	S6220A	ISOstud
S1010G	press-fit	S6200A	press-fit
S1010H	stud	S6210A	stud
S1016B	ISOstud	S6220A	ISOstud
S1016G	press-fit	S6200A	press-fit
S1016H	stud	S6210A	stud
S1025G	press-fit	2N3870	press-fit
S1025H	stud	2N3896	stud
S1035G	press-fit	2N3870	press-fit
S1035H	stud	2N3896	stud
S2003RS2	TO-220	S2060B	TO-220
S2003RS3	TO-220	S2061B	TO-220
S2006B	ISOstud	S6220B	ISOstud
S2006G	press-fit	S6200B	press-fit
S2006H	stud	S6210B	stud
S2008B	ISOstud	S6220B	ISOstud
S2008G	press-fit	S6200B	press-fit
S2008H	stud	S6210B	stud
S2010B	ISOstud	S6220B	ISOstud
S2010G	press-fit	S6200B	press-fit
S2010H	stud	S6210B	stud
S2016B	ISOstud	S6220B	ISOstud
S2016G	press-fit	S6200B	press-fit
S2016H	stud	S6210B	stud
S2025G	press-fit	2N3871	press-fit
S2025H	stud	2N3897	stud
S2035G	press-fit	2N3871	press-fit
S2035H	stud	2N3897	stud
S4006B	ISOstud	S6220D	ISOstud
S4006G	press-fit	S6200D	press-fit
S4006H	stud	S6210D	stud
S4010B	ISOstud	S6220D	ISOstud
S4010G	press-fit	S6200D	press-fit
S4010H	stud	S6210D	stud
S4016B	ISOstud	S6220D	ISOstud
S4016G	press-fit	S6200D	press-fit
S4016H	stud	S6210D	stud
S4025G	press-fit	2N3872	press-fit
S4025H	stud	2N3898	stud
S4035G	press-fit	2N3872	press-fit
S4035H	stud	2N3898	stud
S6003RS2	TO-220	S2060M	TO-220
S6003RS3	TO-220	S2061M	TO-220
S6006B	ISOstud	S6220M	ISOstud
S6006G	press-fit	S6200M	press-fit
S6006H	stud	S6210M	stud
S6008G	press-fit	S6200M	press-fit
S6008H	stud	S6210M	stud
S6010B	ISOstud	S6220M	ISOstud
S6010G	press-fit	S6200M	press-fit
S6010H	stud	S6210M	stud
S6016B	ISOstud	S6220M	ISOstud
S6016G	press-fit	S6200M	press-fit
S6016H	stud	S6210M	stud
S6025G	press-fit	2N3873	press-fit
S6025H	stud	2N3899	stud
S6035G	press-fit	2N3873	press-fit
S6035H	stud	2N3899	stud
S8025C	TO-3	S6410N	stud
S8025D	ISOstud	S6420N	ISOstud
S8025G	press-fit	S6400N	press-fit
S8025H	stud	S6410N	stud
S8035G	press-fit	S6400N	press-fit
S8035H	stud	S6410N	stud
SPS08	stud	S6210A	stud
SPS18	stud	S6210A	stud
SPS020	stud	S6210A	stud
SPS28	stud	S6210B	stud
SPS38	stud	S6210D	stud
SPS48	stud	S6210D	stud
SPS58	stud	S6210M	stud
SPS68	stud	S6210M	stud
SPS120	stud	S6210A	stud
SPS220	stud	S6210B	stud
SPS320	stud	S6210D	stud
SPS420	stud	S6210D	stud
SPS520	stud	S6210M	stud
SPS620	stud	S6210M	stud
TIC106A	TO-220	S2060A	TO-220
TIC106B	TO-220	S2060B	TO-220
TIC106C	TO-220	S2060C	TO-220
TIC106D	TO-220	S2060D	TO-220
TIC106F	TO-220	S2060F	TO-220
TIC106Y	TO-220	S2060Y	TO-220
TIC116A	TO-220	S122A	TO-220
		S2800A	TO-220
TIC116B	TO-220	S122B	TO-220
		S2800B	TO-220
TIC116C	TO-220	S122C	TO-220
TIC116D	TO-220	S122D	TO-220
TIC116E	TO-220	S122E	TO-220
TIC116F	TO-220	S122F	TO-220
TIC116M	TO-220	S122M	TO-220
TIC126A	TO-220	2N6395	TO-220
TIC126B	TO-220	2N6396	TO-220
TIC126C	TO-220	S6000G	TO-220
TIC126D	TO-220	2N6397	TO-220
TIC126E	TO-220	S6000E	TO-220
TIC126F	TO-220	2N6349	TO-220
TIC126M	TO-220	2N6398	TO-220
TY504	TO-220	S2062A	TO-220
TY1004	TO-220	S2062A	TO-220
TY2004	TO-220	S2062B	TO-220
TY3004	TO-220	S2062C	TO-220
TY4004	TO-220	S2062D	TO-220

Power Devices Cross-Reference Guide

(Industry Type to Equivalent RCA Type)

SILICON CONTROLLED RECTIFIERS (CONT'D)

Industry Type	Package	RCA Type	Package
TY5004	TO-220	S2062E	TO-220
TY6004	TO-220	S2062M	TO-220
TY507	TO-220	S122A	TO-220
TY1007	TO-220	S122A	TO-220
TY2007	TO-220	S122B	TO-220
TY3007	TO-220	S122C	TO-220
TY4007	TO-220	S122D	TO-220
TY5007	TO-220	S122E	TO-220
TY6007	TO-220	S122M	TO-220
TY510	TO-220	S2800F	TO-220
TY1010	TO-220	S2800A	TO-220
TY2010	TO-220	S8200B	TO-220
TY3010	TO-220	S2800C	TO-220
TY4010	TO-220	S2800D	TO-220
TY5010	TO-220	S2800E	TO-220
TY6010	TO-220	S2800M	TO-220

TRIACS

Industry Type	Package	RCA Type	Package
2N6068	Case 77	T2303F T2500Q	TO-5 TO-220
2N6068A	Case 77	T2301F	TO-5
2N6068B	Case 77	T2300F	TO-5
2N6069	Case 77	T2303F T2500Y	TO-5 TO-220
2N6069A	Case 77	T2301F	TO-5
2N6069B	Case 77	T2300F	TO-5
2N6070	Case 77	2N5754 T2500A	TO-5 TO-220
2N6070A	Case 77	T2301A	TO-5
2N6070B	Case 77	T2300A	TO-5
2N6071	Case 77	2N5755 T2500B	TO-5 TO-220
2N6071A	Case 77	T2301B	TO-5
2N6071B	Case 77	T2300B	TO-5
2N6072	Case 77	2N5756 T2500C	TO-5 TO-220
2N6072A	Case 77	2N5756	TO-5
2N6072B	Case 77	T2300D	TO-5
2N6073	Case 77	2N5756 T2500D	TO-5 TO-220
2N6073A	Case 77	T2301D	TO-5
2N6073B	Case 77	T2300D	TO-5
2N6074	Case 77	2N5757	TO-5
2N6075	Case 77	2N5757	TO-5
2N6139	stud	2N5569	stud
2N6140	stud	2N5570	stud
2N6141	stud	T4111M	stud
2N6142	stud	2N5569	stud
2N6143	stud	2N5570	stud
2N6144	stud	T4111M	stud
2N6145	ISOstud	T4120B	ISOstud
2N6146	ISOstud	T4120D	ISOstud
2N6147	ISOstud	T4120M	ISOstud
2N6151	Case 90	T2800B	TO-220
2N6152	Case 90	T2800D	TO-220
2N6153	Case 90	T2800M	TO-220
2N6154	Case 90	T2802B	TO-220
2N6155	Case 90	T2802D	TO-220
2N6156	Case 90	T2802M	TO-220
2N6157	press-fit	T6401B	press-fit
2N6158	press-fit	T6401D	press-fit
2N6159	press-fit	T6401M	press-fit
2N6160	stud	T6411B	stud
2N6161	stud	T6411D	stud
2N6162	stud	T6411M	stud
2N6163	ISOstud	T6421B	ISOstud
2N6164	ISOstud	T6421D	ISOstud
2N6165	ISOstud	T6421M	ISOstud
2N6342	TO-220	T2802B	TO-220
2N6343	TO-220	T2802D	TO-220
2N6344	TO-220	T2802M	TO-220
2N6345	TO-220	T2802N	TO-220
2N6346	TO-220	T2800B	TO-220
2N6347	TO-220	T2800D	TO-220
2N6348	TO-220	T2800M	TO-220
2N6349	TO-220	T2800N	TO-220
2N6342A	TO-220	T2802B	TO-220
2N6343A	TO-220	T2802D	TO-220
2N6344A	TO-220	T2802M	TO-220
2N6346A	TO-220	T2800B	TO-220
2N6347A	TO-220	T2800D	TO-220
2N6348A	TO-220	T2800M	TO-220
6T06	TO-66	T2700B	TO-66
6T08	TO-66	T4700B	TO-66
6T16	TO-66	T2700B	TO-66
6T18	TO-66	T4700B	TO-66
6T26	TO-66	T2700B	TO-66
6T28	TO-66	T4700B	TO-66
6T36	TO-66	T2700D	TO-66
6T38	TO-66	T4700D	TO-66
6T46	TO-66	T2700D	TO-66
6T48	TO-66	T4700D	TO-66
BRY41-100	TO-39	2N5754	TO-39
BRY41-200	TO-39	2N5755	TO-39
BRY41-300	TO-39	2N5756	TO-39
BRY41-400	TO-39	2N5757	TO-39
BRY41-500	TO-39	2N5757	TO-39
BRY45-100	TO-39	2N5754	TO-39
BRY45-200	TO-39	2N5755	TO-39
BRY45-300	TO-39	2N5756	TO-39
BRY45-400	TO-39	2N5757	TO-39
BRY45-500	TO-39	2N5757	TO-39
BTR0205	TO-66	T2700B	TO-66
BTR0210	TO-66	T2700B	TO-66
BTR0220	TO-66	T2700B	TO-66
BTR0230	TO-66	T2700D	TO-66
BTR0240	TO-66	T2700D	TO-66
BTR0305	TO-66	T2700B	TO-66
BTR0310	TO-66	T2700B	TO-66
BTR0320	TO-66	T2700B	TO-66
BTR0330	TO-66	T2700D	TO-66
BTR0340	TO-66	T2700D	TO-66
BTR0405	TO-66	T4700B	TO-66
BTR0410	TO-66	T4700B	TO-66
BTR0420	TO-66	T4700B	TO-66
BTR0430	TO-66	T4700D	TO-66
BTR0440	TO-66	T4700D	TO-66
BTS0305	press-fit	2N5567	press-fit
BTS0310	press-fit	2N5567	press-fit
BTS0320	press-fit	2N5567	press-fit
BTS0330	press-fit	2N5568	press-fit
BTS0340	press-fit	2N5568	press-fit
BTS0350	press-fit	T4101M	press-fit
BTS0360	press-fit	T4101M	press-fit
BTS0405	press-fit	2N5567	press-fit
BTS0410	press-fit	2N5567	press-fit
BTS0420	press-fit	2N5567	press-fit
BTS0430	press-fit	2N5568	press-fit
BTS0440	press-fit	2N5568	press-fit
BTS0450	press-fit	T4101M	press-fit
BTS0460	press-fit	T4101M	press-fit
BTS0505	press-fit	2N5571	press-fit
BTS0510	press-fit	2N5571	press-fit
BTS0520	press-fit	2N5571	press-fit
BTS0530	press-fit	2N5572	press-fit
BTS0540	press-fit	2N5572	press-fit
BTS0550	press-fit	T4100M	press-fit
BTS0560	press-fit	T4100M	press-fit
BTS0605	press-fit	2N5441	press-fit
BTS0610	press-fit	2N5441	press-fit
BTS0620	press-fit	2N5441	press-fit
BTS0630	press-fit	2N5442	press-fit
BTS0640	press-fit	2N5442	press-fit
BTS0650	press-fit	2N5443	press-fit
BTS0660	press-fit	2N5443	press-fit
BTU0305	stud	2N5569	stud
BTU0310	stud	2N5569	stud
BTU0320	stud	2N5569	stud
BTU0330	stud	2N5570	stud
BTU0340	stud	2N5570	stud
BTU0350	stud	T4111M	stud
BTU0360	stud	T4111M	stud
BTU0405	stud	2N5569	stud
BTU0410	stud	2N5569	stud
BTU0420	stud	2N5569	stud
BTU0430	stud	2N5570	stud
BTU0440	stud	2N5570	stud
BTU0450	stud	T4111M	stud
BTU0460	stud	T4111M	stud
BTU0505	stud	2N5573	stud
BTU0510	stud	2N5573	stud
BTU0520	stud	2N5573	stud
BTU0530	stud	2N5574	stud
BTU0540	stud	2N5574	stud
BTU0550	stud	T4110M	stud
BTU0560	stud	T4110M	stud
BTU0605	stud	T6411B	stud
BTU0610	stud	T6411B	stud
BTU0620	stud	T6411B	stud
BTU0630	stud	T6411D	stud
BTU0640	stud	T6411D	stud
BTU0650	stud	T6411M	stud
BTU0660	stud	T6411M	stud
BTV0405	ISOstud	T4121B	ISOstud
BTV0410	ISOstud	T4121B	ISOstud
BTV0420	ISOstud	T4121B	ISOstud
BTV0430	ISOstud	T4121D	ISOstud
BTV0440	ISOstud	T4121D	ISOstud
BTV0450	ISOstud	T4121M	ISOstud
BTV0460	ISOstud	T4121M	ISOstud
BTW10-100	TO-66	T2700B	TO-66
BTW10-200	TO-66	T2700B	TO-66
BTW10-300	TO-66	T2700D	TO-66
BTW10-400	TO-66	T2700D	TO-66
BTW11-100	TO-66	T2700B	TO-66

Power Devices Cross-Reference Guide

(Industry Type to Equivalent RCA Type)

TRIACS (CONT'D)

Industry Type	Package	RCA Type	Package
BTW11-200	TO-66	T2700B	TO-66
BTW11-300	TO-66	T2700D	TO-66
BTW11-400	TO-66	T2700D	TO-66
BTW12-100	press-fit	2N5567	press-fit
BTW12-200	press-fit	2N5567	press-fit
BTW12-300	press-fit	2N5568	press-fit
BTW12-400	press-fit	2N5568	press-fit
BTW12-500	press-fit	T4101M	press-fit
BTW13-100	stud	2N5569	stud
BTW13-200	stud	2N5569	stud
BTW13-300	stud	2N5570	stud
BTW13-400	stud	2N5570	stud
BTW13-500	stud	T4111M	stud
BTW14-100	TO-66	T4700B	TO-66
BTW14-200	TO-66	T4700B	TO-66
BTW14-300	TO-66	T4700D	TO-66
BTW14-400	TO-66	T4700D	TO-66
BTW15-100	press-fit	2N5567	press-fit
BTW15-200	press-fit	2N5567	press-fit
BTW15-300	press-fit	2N5568	press-fit
BTW15-400	press-fit	2N5568	press-fit
BTW15-500	press-fit	T4101M	press-fit
BTW16-100	stud	2N5569	stud
BTW16-200	stud	2N5569	stud
BTW16-300	stud	2N5570	stud
BTW16-400	stud	2N5570	stud
BTW16-500	stud	T4111M	stud
BTW18-100	press-fit	2N5571	press-fit
BTW18-200	press-fit	2N5571	press-fit
BTW18-300	press-fit	2N5572	press-fit
BTW18-400	press-fit	2N5572	press-fit
BTW18-500	press-fit	T4101M	press-fit
BTW19-100	press-fit	2N5571	press-fit
BTW19-200	press-fit	2N5571	press-fit
BTW19-300	press-fit	2N5572	press-fit
BTW19-400	press-fit	2N5572	press-fit
BTW19-500	press-fit	T4101M	press-fit
BTW20-100	stud	T6411B	stud
BTW20-200	stud	T6411B	stud
BTW20-300	stud	T6411D	stud
BTW20-400	stud	T6411D	stud
BTW20-500	stud	T6411M	stud
BTX94-400	stud	T6411D	stud
BTX94-500	stud	T6411M	stud
BTX94-600	stud	T6411M	stud
BTX0505	ISOstud	T4120B	ISOstud
BTX0510	ISOstud	T4120B	ISOstud
BTX0520	ISOstud	T4120B	ISOstud
BTX0530	ISOstud	T4120D	ISOstud
BTX0540	ISOstud	T4120D	ISOstud
BTX0550	ISOstud	T4120M	ISOstud
BTX0560	ISOstud	T4120M	ISOstud
BTX0605	ISOstud	T6421B	ISOstud
BTX0610	ISOstud	T6421B	ISOstud
BTX0620	ISOstud	T6421B	ISOstud
BTX0630	ISOstud	T6421D	ISOstud
BTX0640	ISOstud	T6421D	ISOstud
BTX0650	ISOstud	T6421M	ISOstud
BTX0660	ISOstud	T6421M	ISOstud
HB26	TO-5	2N5755	TO-5
HB46	TO-5	2N5756	TO-5
H103SC	TO-5	T2301F	TO-5
H103SD	TO-5	T2301A	TO-5
H103SG	TO-5	T2302F	TO-5
H103SH	TO-5	T2303F	TO-5
H103SS	TO-5	T2300F	TO-5
H113SC	TO-5	T2301A	TO-5
H113SD	TO-5	T2301A	TO-5
H113SG	TO-5	T2302A	TO-5
H113SH	TO-5	2N5754	TO-5
H113SS	TO-5	T2300A	TO-5
H123SC	TO-5	T2301B	TO-5
H123SD	TO-5	T2301B	TO-5
H123SG	TO-5	T2302B	TO-5
H123SH	TO-5	2N5755	TO-5
H123SS	TO-5	T2300B	TO-5
H133SC	TO-5	T2301D	TO-5
H133SD	TO-5	T2301D	TO-5
H133SG	TO-5	T2302D	TO-5
H133SH	TO-5	2N5756	TO-5
H133SS	TO-5	T2300D	TO-5
H143SC	TO-5	T2301D	TO-5
H143SD	TO-5	T2301D	TO-5
H143SG	TO-5	T2302D	TO-5
H143SH	TO-5	2N5756	TO-5
H143SS	TO-5	T2300D	TO-5
H153SH	TO-5	2N5757	TO-5
H163SH	TO-5	2N5757	TO-5
IT06	TO-220	T2850A	TO-220
IT08	TO-220	T2850A	TO-220
IT16	TO-220	T2850A	TO-220
IT18	TO-220	T2850A	TO-220
IT26	TO-220	T2850B	TO-220
IT28	TO-220	T2850B	TO-220
IT36	TO-220	T2850D	TO-220
IT38	TO-220	T2850D	TO-220
IT46	TO-220	T2850D	TO-220
IT48	TO-220	T2850D	TO-220
L2001M3	TO-39 low profile	T2300B	TO-39
L2001M4	TO-39 low profile	T2300B	TO-39
L2001M5	TO-39 low profile	T2301B	TO-39
L2001M7	TO-39 low profile	T2302B	TO-39
L2001M9	TO-39 low profile	2N5755	TO-5
L4001M3	TO-39 low profile	T2300D	TO-39
L4001M4	TO-39 low profile	T2300D	TO-39
L4001M5	TO-39 low profile	T2301D	TO-39
L4001M7	TO-39 low profile	T2302D	TO-39
L4001M9	TO-39 low profile	2N5756	TO-5
MAC-1-1	Case 85	2N5567	press-fit
MAC-1-2	Case 85	2N5567	press-fit
MAC-1-3	Case 85	2N5567	press-fit
MAC-1-4	Case 85	2N5567	press-fit
MAC-1-5	Case 85	2N5568	press-fit
MAC-1-6	Case 85	2N5568	press-fit
MAC-1-7	Case 85	T4101M	press-fit
MAC-1-8	Case 85	T4101M	press-fit
MAC-2-1	Case 86	2N5569	stud
MAC-2-2	Case 86	2N5569	stud
MAC-2-3	Case 86	2N5569	stud
MAC-5-1	stud	2N5569	stud
MAC-5-2	stud	2N5569	stud
MAC-5-3	stud	2N5569	stud
MAC-5-4	stud	2N5569	stud
MAC-5-5	stud	2N5570	stud
MAC-5-6	stud	2N5570	stud
MAC-5-7	stud	T4111M	stud
MAC-5-8	stud	T4111M	stud
MAC-10-1	Case 90	T2800B	TO-220
MAC-10-2	Case 90	T2800B	TO-220
MAC-10-3	Case 90	T2800B	TO-220
MAC-10-4	Case 90	T2800B	TO-220
MAC-10-5	Case 90	T2800C	TO-220
MAC-10-6	Case 90	T2800D	TO-220
MAC-10-7	Case 90	T2800E	TO-220
MAC-10-8	Case 90	T2800M	TO-220
MAC-11-1	Case 90	T2802B	TO-220
MAC-11-2	Case 90	T2802B	TO-220
MAC-11-3	Case 90	T2802B	TO-220
MAC-11-4	Case 90	T2802B	TO-220
MAC-11-5	Case 90	T2802C	TO-220
MAC-11-6	Case 90	T2802D	TO-220
MAC-11-7	Case 90	T2802E	TO-220
MAC-11-8	Case 90	T2802M	TO-220
MAC-35-1	press-fit	T6401B	press-fit
MAC-35-2	press-fit	T6401B	press-fit
MAC-35-3	press-fit	T6401B	press-fit
MAC-35-4	press-fit	T6401B	press-fit
MAC-35-5	press-fit	T6401D	press-fit
MAC-35-6	press-fit	T6401D	press-fit
MAC-35-7	press-fit	T6401M	press-fit
MAC-36-1	stud	T6411B	stud
MAC-36-2	stud	T6411B	stud
MAC-36-3	stud	T6411B	stud
MAC-36-4	stud	T6411B	stud
MAC-36-5	stud	T6411D	stud
MAC-36-6	stud	T6411D	stud
MAC-36-7	stud	T6411M	stud
MAC-37-1	press-fit	T6401B	press-fit
MAC-37-2	press-fit	T6401B	press-fit
MAC-37-3	press-fit	T6401B	press-fit
MAC-37-4	press-fit	T6401B	press-fit
MAC-37-5	press-fit	T6401D	press-fit
MAC-37-6	press-fit	T6401D	press-fit
MAC-37-7	press-fit	T6401M	press-fit
MAC-38-1	stud	T6411B	stud
MAC-38-2	stud	T6411B	stud
MAC-38-3	stud	T6411B	stud
MAC-38-4	stud	T6411B	stud
MAC-38-5	stud	T6411D	stud
MAC-38-6	stud	T6411D	stud
MAC-38-7	stud	T6411M	stud
MAC92A-1	TO-92	T2301F	TO-5
MAC92A-2	TO-92	T2301A	TO-5
MAC92A-3	TO-92	T2301A	TO-5

TRIACS (CONT'D)

Industry Type	Package	RCA Type	Package
MAC92A-4	TO-92	T2301B	TO-5
MAC92A-5	TO-92	T2301D	TO-5
MAC92A-6	TO-92	T2301D	TO-5
MAC93A-1	TO-92	T2301F	TO-5
MAC93A-2	TO-92	T2301A	TO-5
MAC93A-3	TO-92	T2301A	TO-5
MAC93A-4	TO-92	T2301B	TO-5
MAC94A-1	TO-92	T2301F	TO-5
MAC94A-2	TO-92	T2301A	TO-5
MAC94A-3	TO-92	T2301A	TO-5
MAC94A-4	TO-92	T2301B	TO-5
MAC40688	ISOstud	T6420B	ISOstud
MAC40689	ISOstud	T6420D	ISOstud
MAC40690	ISOstud	T6420M	ISOstud
MAC40797	press-fit	T4100M	press-fit
MAC40798	stud	T4110M	stud
PT06	press-fit	2N5567	press-fit
PT08	press-fit	2N5567	press-fit
PT10	press-fit	2N5567	press-fit
PT15	press-fit	2N5567	press-fit
PT16	press-fit	2N5567	press-fit
PT18	press-fit	2N5567	press-fit
PTO25	press-fit	T6401B	press-fit
PTO26	press-fit	2N5867	press-fit
PTO28	press-fit	2N6567	press-fit
PTO30	press-fit	T6401B	press-fit
PTO36	press-fit	2N5568	press-fit
PTO38	press-fit	2N5568	press-fit
PTO40	press-fit	2N5441	press-fit
PTO46	press-fit	2N5568	press-fit
PTO48	press-fit	2N5568	press-fit
PTO56	press-fit	T4101M	press-fit
PTO58	press-fit	T4101M	press-fit
PTO66	press-fit	T4101M	press-fit
PTO68	press-fit	T4101M	press-fit
PT110	press-fit	2N5567	press-fit
PT115	press-fit	2N5571	press-fit
PT125	press-fit	T6401B	press-fit
PT130	press-fit	T6401B	press-fit
PT140	press-fit	2N5441	press-fit
PT210	press-fit	2N5567	press-fit
PT215	press-fit	2N5571	press-fit
PT225	press-fit	T6401B	press-fit
PT230	press-fit	T6401B	press-fit
PT240	press-fit	2N5441	press-fit
PT310	press-fit	2N5568	press-fit
PT315	press-fit	2N5572	press-fit
PT325	press-fit	T6401D	press-fit
PT330	press-fit	T6401D	press-fit
PT340	press-fit	2N5442	press-fit
PT410	press-fit	2N5568	press-fit
PT415	press-fit	2N5572	press-fit
PT425	press-fit	T6401D	press-fit
PT430	press-fit	T6401D	press-fit
PT440	press-fit	2N5442	press-fit
PT510	press-fit	T4101M	press-fit
PT515	press-fit	T4100M	press-fit
PT525	press-fit	T6401M	press-fit
PT530	press-fit	T6401M	press-fit
PT540	press-fit	2N5443	press-fit
PT610	press-fit	T4101M	press-fit
PT615	press-fit	T4100M	press-fit
PT625	press-fit	T6401M	press-fit
PT630	press-fit	T6401M	press-fit
Q2001MS2	TO-5	T2302B	TO-5
Q2001M2	TO-5	2N5755	TO-5
Q2003P	TO-5	T2800B	TO-5
Q2004	ISOstud	T4120B	ISOstud
Q2006L4	ISO TO-220	T2850B	ISO TO-220
Q2008	ISOstud	T4121B	ISOstud
Q2010	ISOstud	T4121B	ISOstud
Q2015	ISOstud	T4120B	ISOstud
Q2025	ISOstud	T6421B	ISOstud
Q2040	ISOstud	T6420B	ISOstud
Q4001MS2	TO-5	T2302D	TO-5
Q4001M2	TO-5	2N5756	TO-5
Q4003L4	ISO TO-220	T2850D	ISO TO-220
Q4004	ISOstud	T4121D	ISOstud
Q4004L4	ISO TO-220	T2850D	ISO TO-220
Q4006	ISOstud	T4121D	ISOstud
Q4006L4	ISO TO-220	T2850D	ISO TO-220
Q4008	ISOstud	T4121D	ISOstud
Q4010	ISOstud	T4121D	ISOstud
Q4015	ISOstud	T4120D	ISOstud
Q4025	ISOstud	T6421D	ISOstud
Q4040	ISOstud	T6420D	ISOstud
Q5006L4	ISO TO-220	T2850D	ISO TO-220
Q5008	ISOstud	T4121M	ISOstud
Q5010	ISOstud	T4121M	ISOstud
Q4015	ISOstud	T4120M	ISOstud
Q5025	ISOstud	T6421M	ISOstud
Q5040	ISOstud	T6420M	ISOstud
Q6008	ISOstud	T4121M	ISOstud
Q6010	ISOstud	T4121M	ISOstud
Q6015	ISOstud	T4120M	ISOstud
Q6025	ISOstud	T6421M	ISOstud
Q6040	ISOstud	T6420M	ISOstud
Q8025	ISOstud	T6420N	ISOstud
Q8040	ISOstud	T6420N	ISOstud
SC35A	stud	2N5569	stud
SC35B	stud	2N5569	stud
SC35D	stud	2N5570	stud
SC35F	stud	2N5569	stud
SC36A	press-fit	2N5567	press-fit
SC36B	press-fit	2N5567	press-fit
SC36D	press-fit	2N5568	press-fit
SC36F	press-fit	2N5567	press-fit
SC40A	stud	2N5569	stud
SC40B	stud	2N5569	stud
SC40B2	ISOstud	T4121B	ISOstud
SC40D	stud	2N5570	stud
SC40D2	ISOstud	T4121D	ISOstud
SC40E	stud	T4111M	stud
SC40E2	ISOstud	T4121M	ISOstud
SC40F	stud	2N5569	stud
SC41A	press-fit	2N5567	press-fit
SC41B	press-fit	2N5567	press-fit
SC41D	press-fit	2N5568	press-fit
SC41E	press-fit	T4101M	press-fit
SC41F	press-fit	2N5567	press-fit
SC45A	stud	2N5569	stud
SC45B	stud	2N5569	stud
SC45B2	ISOstud	T4121B	ISOstud
SC45D	stud	2N5570	stud
SC45D2	ISOstud	T4121D	ISOstud
SC45E	stud	T4111M	stud
SC45E2	ISOstud	T4121M	ISOstud
SC45F	stud	2N5569	stud
SC46A	press-fit	2N5567	press-fit
SC46B	press-fit	2N5567	press-fit
SC46D	press-fit	2N5568	press-fit
SC46E	press-fit	T4101M	press-fit
SC46F	press-fit	2N5567	press-fit
SC50A	stud	2N5573	stud
SC50B	stud	2N5573	stud
SC50B2	ISOstud	T4120B	ISOstud
SC50D	stud	2N5574	stud
SC50D2	ISOstud	T4120D	ISOstud
SC50E	stud	2N5573 T4110M	stud stud
SC50E2	ISOstud	T4120M	ISOstud
SC50F	stud	2N5573	stud
SC51A	press-fit	2N5571	press-fit
SC51B	press-fit	2N5571	press-fit
SC51D	press-fit	2N5572	press-fit
SC51E	press-fit	T4100M	press-fit
SC51F	press-fit	2N5571	press-fit
SC60B	stud	T6411B	stud
SC60B2	ISOstud	T6421B	ISOstud
SC60B12	stud	T6411B	stud
SC60B13	stud	T6411B	stud
SC60B14	stud	T6414B	stud
SC60B22	ISOstud	T6421B	ISOstud
SC60B23	ISOstud	T6421B	ISOstud
SC60D	stud	T6411D	stud
SC60D2	ISOstud	T6421D	ISOstud
SC60D12	stud	T6411D	stud
SC60D13	stud	T6411D	stud
SC60D14	stud	T6414D	stud
SC60D22	ISOstud	T6421D	ISOstud
SC60D23	ISOstud	T6421D	ISOstud
SC60E	stud	T6411M	stud
SC60E2	ISOstud	T6421M	ISOstud
SC60E12	stud	T6411M	stud
SC60E13	stud	T6411M	stud
SC60E22	ISOstud	T6421M	ISOstud
SC60E23	ISOstud	T6421M	ISOstud
SC61B	press-fit	T6401B	press-fit
SC61B12	press-fit	T6401B	press-fit
SC61B13	press-fit	T6401B	press-fit
SC61B14	press-fit	T6404B	press-fit
SC61D	press-fit	T6401D	press-fit
SC61D12	press-fit	T6401D	press-fit
SC61D13	press-fit	T6401D	press-fit
SC61D14	press-fit	T6404D	press-fit
SC61E	press-fit	T6401M	press-fit
SC61E12	press-fit	T6401M	press-fit
SC61E13	press-fit	T6401M	press-fit

Power Devices Cross-Reference Guide

(Industry Type to Equivalent RCA Type)

TRIACS (CONT'D)

Industry Type	Package	RCA Type	Package
SC136A	TO-202	2N5754	TO-5
SC136B	TO-202	2N5755	TO-5
SC136D	TO-202	2N5756	TO-5
SC141B	TO-220	T2800B	TO-220
SC141D	TO-220	T2800D	TO-220
SC141E	TO-220	T2800E	TO-220
SC141M	TO-220	T2800M	TO-220
SC146B	TO-220	T2800B	TO-220
SC146D	TO-220	T2800D	TO-220
SC146E	TO-220	T2800E	TO-220
SC146M	TO-220	T2800M	TO-220
SC240B	stud	2N5569	stud
SC240B2	ISOstud	T4121B	ISOstud
SC240B12	stud	2N5569	stud
SC240B13	stud	2N5569	stud
SC240B22	ISOstud	T4121B	ISOstud
SC240B23	ISOstud	T4121B	ISOstud
SC240D	stud	2N5570	stud
SC240D2	ISOstud	T4121D	ISOstud
SC240D12	stud	2N5570	stud
SC240D13	stud	2N5570	stud
SC240D22	ISOstud	T4121D	ISOstud
SC240D23	ISOstud	T4121D	ISOstud
SC240E	stud	T4111M	stud
SC240E2	ISOstud	T4121M	ISOstud
SC240E12	stud	T4111M	stud
SC240E13	stud	T4111M	stud
SC240E22	ISOstud	T4121M	ISOstud
SC240E23	ISOstud	T4121M	ISOstud
SC241B	press-fit	2N5567	press-fit
SC241B12	press-fit	2N5567	press-fit
SC241B13	press-fit	2N5567	press-fit
SC241D	press-fit	2N5568	press-fit
SC241D12	press-fit	2N5568	press-fit
SC241D13	press-fit	2N5568	press-fit
SC241E	press-fit	T4101M	press-fit
SC241E12	press-fit	T4101M	press-fit
SC241E13	press-fit	T4101M	press-fit
SC245B	stud	2N5569	stud
SC245B2	ISOstud	T4121B	ISOstud
SC245B12	stud	2N5569	stud
SC245B13	stud	2N5569	stud
SC245B14	stud	T4115B	stud
SC245B22	ISOstud	T4121B	ISOstud
SC245B23	ISOstud	T4121B	ISOstud
SC245D	stud	2N5570	stud
SC245D2	ISOstud	T4121D	ISOstud
SC245D12	stud	2N5570	stud
SC245D13	stud	2N5570	stud
SC245D14	stud	T4115D	stud
SC245D22	ISOstud	T4121D	ISOstud
SC245D23	ISOstud	T4121D	ISOstud
SC245E	stud	T4111M	stud
SC245E2	ISOstud	T4121M	ISOstud
SC245E12	stud	T4111M	stud
SC245E13	stud	T4111M	stud
SC245E22	ISOstud	T4121M	ISOstud
SC245E23	ISOstud	T4121M	ISOstud
SC246B	press-fit	2N5567	press-fit
SC246B12	press-fit	2N5567	press-fit
SC246B13	press-fit	2N5567	press-fit
SC246B14	press-fit	T4105B	press-fit
SC246D	press-fit	2N5568	press-fit
SC246D12	press-fit	2N5568	press-fit
SC246D13	press-fit	2N5568	press-fit
SC246D14	press-fit	T4105D	press-fit
SC246E	press-fit	T4101M	press-fit
SC246E12	press-fit	T4101M	press-fit
SC246E13	press-fit	T4101M	press-fit
SC250B	stud	2N5573	stud
SC250B2	ISOstud	T4120B	ISOstud
SC250B12	stud	2N5573	stud
SC250B13	stud	2N5573	stud
SC250B14	stud	T4113B	stud
SC250B22	ISOstud	T4120B	ISOstud
SC250D	stud	2N5574	stud
SC250D2	ISOstud	T4120D	ISOstud
SC250D12	stud	2N5574	stud
SC250D13	stud	2N5574	stud
SC250D14	stud	T4113D	stud
SC250D22	ISOstud	T4120D	ISOstud
SC250E	stud	T4110M	stud
SC250E2	ISOstud	T4120M	ISOstud
SC250E12	stud	T4110M	stud
SC250E13	stud	T4110M	stud
SC250E22	ISOstud	T4120M	ISOstud
SC251B	press-fit	2N5571	press-fit
SC251B12	press-fit	2N5571	press-fit
SC251B13	press-fit	2N5571	press-fit
SC251B14	press-fit	T4103B	press-fit
SC251D	press-fit	2N5572	press-fit
SC251D12	press-fit	2N5572	press-fit
SC251D13	press-fit	2N5572	press-fit
SC251D14	press-fit	T4103D	press-fit
SC251E	press-fit	T4100M	press-fit
SC251E12	press-fit	T4100M	press-fit
SC251E13	press-fit	T4100M	press-fit
SPT06	stud	2N5569	stud
SPT08	stud	2N5569	stud
SPT10	stud	2N5569	stud
SPT15	stud	2N5573	stud
SPT16	stud	2N5569	stud
SPT18	stud	2N5569	stud
SPT025	stud	T6411B	stud
SPT030	stud	T6411B	stud
SPT26	stud	2N5569	stud
SPT28	stud	2N5569	stud
SPT36	stud	2N5570	stud
SPT38	stud	2N5570	stud
SPT40	stud	2N5444	stud
SPT46	stud	2N5570	stud
SPT48	stud	2N5570	stud
SPT56	stud	T4111M	stud
SPT58	stud	T4111M	stud
SPT68	stud	T4111M	stud
SPT110	stud	2N5569	stud
SPT115	stud	2N5573	stud
SPT125	stud	T6411B	stud
SPT130	stud	T6411B	stud
SPT140	stud	2N5444	stud
SPT210	stud	2N5569	stud
SPT215	stud	2N5573	stud
SPT225	stud	T6411B	stud
SPT230	stud	T6411B	stud
SPT240	stud	2N5444	stud
SPT310	stud	2N5570	stud
SPT315	stud	2N5574	stud
SPT325	stud	T6411D	stud
SPT330	stud	T6411D	stud
SPT340	stud	2N5445	stud
SPT410	stud	2N5570	stud
SPT415	stud	2N5574	stud
SPT425	stud	T6411D	stud
SPT430	stud	T6411D	stud
SPT440	stud	2N5445	stud
SPT510	stud	T4111M	stud
SPT515	stud	T4110M	stud
SPT525	stud	T6411M	stud
SPT530	stud	T6411M	stud
SPT540	stud	2N5446	stud
SPT610	stud	T4111M	stud
SPT615	stud	T4110M	stud
SPT625	stud	T6411M	stud
SPT630	stud	T6411M	stud
SPT640	stud	2N5446	stud
TIC20	press-fit	2N5567	press-fit
TIC21	press-fit	2N5568	press-fit
TIC22	stud	2N5569	stud
TIC23	stud	2N5570	stud
TIC226B	TO-220	T2800B	TO-220
TIC226D	TO-220	T2800D	TO-220
TIC236B	TO-220	T2800B	TO-220
TIC236D	TO-220	T2800D	TO-220
TIC250B	press-fit	T6401B	press-fit
TIC250D	press-fit	T6401D	press-fit
TIC250E	press-fit	T6401M	press-fit
TIC250M	press-fit	T6401M	press-fit
TIC252B	stud	T6411B	stud
TIC252D	stud	T6411D	stud
TIC252E	stud	T6411M	stud
TIC252M	stud	T6411M	stud
TIC260B	press-fit	T6401B	press-fit
TIC260D	press-fit	T6401D	press-fit
TIC260E	press-fit	T6401M	press-fit
TIC260M	press-fit	T6401M	press-fit
TIC262B	stud	T6411B	stud
TIC262D	stud	T6411D	stud
TIC262E	stud	T6411M	stud
TIC262M	stud	T6411M	stud
TIC270B	press-fit	2N5441	press-fit
TIC270D	press-fit	2N5442	press-fit
TIC270E	press-fit	2N5443	press-fit
TIC270M	press-fit	2N5443	press-fit
TIC272B	stud	2N5444	stud
TIC272D	stud	2N5445	stud
TIC272E	stud	2N5446	stud
TIC272M	stud	2N5446	stud
TDAL113A	TO-39	2N5754	TO-39
TDAL223A	TO-39	2N5756	TO-39
TDAL113B	TO-39	T2302B	TO-39
TDAL223B	TO-39	T2302D	TO-39
TDAL113S	TO-39	T2300B	TO-39
TDAL2235	TO-39	T2300D	TO-39
TJAL602D	stud	T8411B	stud
TJAL604D	stud	T8411D	stud

Power Devices Cross-Reference Guide

(Industry Type to Equivalent RCA Type)

TRIACS (CONT'D)

Industry Type	Package	RCA Type	Package
TJAL606D	stud	T8411M	stud
TRAL1110D	TO-48	2N5569	stud
TRAL1115D	TO-48	2N5573	stud
TRAL1125D	TO-48	T6411B	stud
TRAL1130D	ISOstud	T6421B	ISOstud
TRAL1140D	ISOstud	T6420B	ISOstud
TRAL2210D	TO-48	2N5570	stud
TRAL2215D	TO-48	2N5574	stud
TRAL2225D	TO-48	T6411D	stud
TRAL2230D	ISOstud	T6421D	ISOstud
TRAL2240D	ISOstud	T6420D	ISOstud
TX01A10	TO-66	T2700A	TO-66
TXC01A20	TO-66	T2700B	TO-66
TXC01A40	TO-66	T2700D	TO-66
TXC01B10	TO-66	T2700A	TO-66
TXC01B20	TO-66	T2700B	TO-66
TXC01B40	TO-66	T2700D	TO-66
TXC01C10	TO-66	T2700A	TO-66
TXC01C20	TO-66	T2700B	TO-66
TXC01C40	TO-66	T2700D	TO-66
TXC01D10	TO-66	T2700A	TO-66
TXC01D20	TO-66	T2700B	TO-66
TXC01D40	TO-66	T2700D	TO-66
TXC01E10	TO-66	T2700A	TO-66
TXC01E20	TO-66	T2700B	TO-66
TXC01E40	TO-66	T2700D	TO-66
TXC01F10	TO-66	T2700A	TO-66
TXC01F20	TO-66	T2700B	TO-66
TXC01F40	TO-66	T2700D	TO-66
TXC03A10	MU22	T2500A	TO-220
TXC03A20	MU22	T2500B	TO-220
TXC03A40	MU22	T2500D	TO-220
TXC03A50	MU22	T2500E	TO-220
TXC03B10	MU22	T2500A	TO-220
TXC03B20	MU22	T2500B	TO-220
TXC03B40	MU22	T2500D	TO-220
TXC03B50	MU22	T2500E	TO-220
TXC03C10	MU22	T2500A	TO-220
TXC03C20	MU22	T2500B	TO-220
TXC03C40	MU22	T2500D	TO-220
TXC03C50	MU22	T2500E	TO-220
TXC03D10	MU22	T2500A	TO-220
TXC03D20	MU22	T2500B	TO-220
TXC03D40	MU22	T2500D	TO-220
TXC03D50	MU22	T2500E	TO-220
TXC03E10	MU22	T2500A	TO-220
TXC03E20	MU22	T2500B	TO-220
TXC03E40	MU22	T2500D	TO-220
TXC03E50	MU22	T2500E	TO-220
TXC03F10	MU22	T2500A	TO-220
TXC03F20	MU22	T2500B	TO-220
TXC03F40	MU22	T2500D	TO-220
TXC03F50	MU22	T2500E	TO-220
TXD98A20	stud	2N5573	stud
TXD98A40	stud	2N5574	stud
TXD98A50	stud	T4110M	stud
TXD99A20	stud	2N5569	stud
TXD99A40	stud	2N5570	stud
TXD99A50	stud	T4111M	stud
TXE99A20	stud	T6411B	stud
TXE99A40	stud	T6411D	stud
TXE99A50	stud	T6411M	stud
TYAL113B	TO-220	T2500B	TO-220
TYAL113C	TO-220	T2500B	TO-220
TYAL113M	TO-220	T2801B	TO-220
TYAL116B	TO-220	T2500B	TO-220
TYAL116C	TO-220	T2500B	TO-220
TYAL116M	TO-220	T2801B	TO-220
TYAL118B	TO-220	T2800B	TO-220
TYAL118C	TO-220	T2800B	TO-220
TYAL118M	TO-220	T2802B	TO-220
TYAL223B	TO-220	T2500D	TO-220
TYAL223C	TO-220	T2500D	TO-220
TYAL223M	TO-220	T2801D	TO-220
TYAL226B	TO-220	T2500D	TO-220
TYAL226C	TO-220	T2500D	TO-220
TYAL226M	TO-220	T2801D	TO-220
TYAL228B	TO-220	T2800D	TO-220
TYAL228C	TO-220	T2800D	TO-220
TYAL228M	TO-220	T2802D	TO-220
TYAL1110B	TO-220	T2800B	TO-220
TYAL1110C	TO-220	T2800B	TO-220
TYAL1110M	TO-220	T2802B	TO-220
TYAL2210B	TO-220	T2800D	TO-220
TYAL2210C	TO-220	T2800D	TO-220
TYAL2210M	TO-220	T2802D	TO-220

Operating Considerations

Solid state devices are being designed into an increasing variety of electronic equipment because of their high standards of reliability and performance. However, it is essential that equipment designers be mindful of good engineering practices in the use of these devices to achieve the desired performance.

This Note summarizes important operating recommendations and precautions which should be followed in the interest of maintaining the high standards of performance of solid state devices.

The ratings included in RCA Solid State Devices data bulletins are based on the Absolute Maximum Rating System, which is defined by the following Industry Standard (JEDEC) statement:

Absolute-Maximum Ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in device characteristics.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in device characteristics.

It is recommended that equipment manufacturers consult RCA whenever device applications involve unusual electrical, mechanical or environmental operating conditions.

GENERAL CONSIDERATIONS

The design flexibility provided by these devices makes possible their use in a broad range of applications and under many different operating conditions. When incorporating these devices in equipment, therefore, designers should anticipate the rare possibility of device failure and make certain that no safety hazard would result from such an occurrence.

The small size of most solid state products provides obvious advantages to the designers of electronic equipment. However, it should be recognized that these compact devices usually provide only relatively small insulation area between adjacent leads and the metal envelope. When these devices are used in moist or contaminated atmospheres, therefore, supplemental protection must be provided to prevent the development of electrical conductive paths across the relatively small insulating surfaces. For specific information on voltage creepage, the user should consult references such as the JEDEC Standard No. 7 "Suggested Standard on Thyristors," and JEDEC Standard RS282 "Standards for Silicon Rectifier Diodes and Stacks".

The metal shells of some solid state devices operate at the collector voltage and for some rectifiers and thyristors at the anode voltage. Therefore, consideration should be given to the possibility of shock hazard if the shells are to operate at voltages appreciably above or below ground potential. In general, in any application in which devices are operated at voltages which may be dangerous to personnel, suitable precautionary measures should be taken to prevent direct contact with these devices.

Devices should not be connected into or disconnected from circuits with the power on because high transient voltages may cause permanent damage to the devices.

TESTING PRECAUTIONS

In common with many electronic components, solid-state devices should be operated and tested in circuits which have reasonable values of current limiting resistance, or other forms of effective current overload protection. Failure to observe these precautions can cause excessive internal heating of the device resulting in destruction and/or possible shattering of the enclosure.

TRANSISTORS AND THYRISTORS WITH FLEXIBLE LEADS

Flexible leads are usually soldered to the circuit elements. It is desirable in all soldering operatings to provide some slack or an expansion elbow in each lead to prevent excessive tension on the leads. It is important during the soldering operation to avoid excessive heat in order to prevent possible damage to the devices. Some of the heat can be absorbed if the flexible lead of the device is grasped between the case and the soldering point with a pair of pliers.

TRANSISTORS AND THYRISTORS WITH MOUNTING FLANGES

The mounting flanges of JEDEC-type packages such as the TO-3 or TO-66 often serve as the collector or anode terminal. In such cases, it is essential that the mounting flange be securely fastened to the heat sink, which may be the equipment chassis. Under no circumstances, however, should the mounting flange of a transistor be soldered directly to the heat sink or chassis because the heat of the soldering operation could permanently damage the device. Soldering is the preferred method for mounting thyristors; see "Rectifiers and Thyristors," below. Devices which cannot be soldered can be installed in commercially available sockets. Electrical connections may also be made by soldering directly to the terminal pins. Such connections may be soldered to the pins close to the pin seals provided care is taken to conduct excessive heat away from the seals; otherwise the heat of the soldering operation could crack the pin seals and damage the device.

During operation, the mounting-flange temperature is higher than the ambient temperature by an amount which depends on the heat sink used. The heat sink must have sufficient thermal capacity to assure that the heat dissipated in the heat sink itself does not raise the device mounting-flange temperature above the rated value. The heat sink or chassis may be connected to either the positive or negative supply.

In many applications the chassis is connected to the voltage-supply terminal. If the recommended mounting hardware shown in the data bulletin for the specific solid-state device is not available, it is necessary to use either an anodized aluminum insulator having high thermal conductivity or a mica insulator between the mounting-flange and the chassis. If an insulating aluminum washer is required, it should be drilled or punched to provide the two mounting holes for the terminal pins. The burrs should then be removed from the washer and the washer anodized. To insure that the anodized insulating layer is not destroyed during mounting, it is necessary to remove the burrs from the holes in the chassis.

It is also important that an insulating bushing, such as glass-filled nylon, be used between each mounting bolt and the chassis to prevent a short circuit. However, the insulating bushing should not exhibit shrinkage or softening under the operating temperatures encountered. Otherwise the thermal resistance at the interface between device and heat sink may increase as a result of decreasing pressure.

PLASTIC POWER TRANSISTORS AND THYRISTORS

RCA power transistors and thyristors (SCR's and triacs) in molded-silicone-plastic packages are available in a wide range of power-dissipation ratings and a variety of package configurations. The following paragraphs provide guidelines for handling and mounting of these plastic-package devices, recommend forming of leads to meet specific mounting requirements, and describe various mounting arrangements, thermal considerations, and cleaning methods. This information is intended to augment the data on electrical characteristics, safe operating area, and performance capabilities in the technical bulletin for each type of plastic-package transistor or thyristor.

Lead-Forming Techniques

The leads of the RCA VERSAWATT in-line plastic packages can be formed to a custom shape, provided they are not indiscriminately twisted or bent. Although these leads can be formed, they are not flexible in the general sense, nor are they sufficiently rigid for unrestrained wire wrapping

Before an attempt is made to form the leads of an in-line package to meet the requirements of a specific application, the desired lead configuration should be determined, and a lead-bending fixture should be designed and constructed. The use of a properly designed fixture for this operation eliminates the need for repeated lead bending. When the use of a special bending fixture is not practical, a pair of long-nosed pliers may be used. The pliers should hold the lead firmly between the bending point and the case, but should not touch the case.

When the leads of an in-line plastic package are to be formed, whether by use of long-nosed pliers or a special bending fixture, the following precautions must be observed to avoid internal damage to the device:

1. Restrain the lead between the bending point and the plastic case to prevent relative movement between the lead and the case.
2. When the bend is made in the plane of the lead (spreading), bend only the narrow part of the lead.
3. When the bend is made in the plane perpendicular to that of the leads, make the bend at least 1/8 inch from the plastic case.
4. Do not use a lead-bend radius of less than 1/16 inch.
5. Avoid repeated bending of leads.

The leads of the TO-220AB VERSAWATT in-line package are not designed to withstand excessive axial pull. Force in this direction greater than 4 pounds may result in permanent damage to the device. If the mounting arrangement tends to impose axial stress on the leads, some method of strain relief should be devised.

Wire wrapping of the leads is permissible, provided that the lead is restrained between the plastic case and the point of the wrapping. Soldering to the leads is also allowed. The maximum soldering temperature, however, must not exceed 275°C and must be applied for not more than 5 seconds at a distance not less than 1/8 inch from the plastic case. When wires are used for connections, care should be exercised to assure that movement of the wire does not cause movement of the lead at the lead-to-plastic junctions.

The leads of RCA molded-plastic high-power packages are not designed to be reshaped. However, simple bending of the leads is permitted to change them from a standard vertical to a standard horizontal configuration, or conversely. Bending of the leads in this manner is restricted to three 90-degree bends; repeated bendings should be avoided.

Mounting

Recommended mounting arrangements and suggested hardward for the VERSAWATT package are given in the data bulletins for specific devices and in RCA Application Note AN-4142. When the package is fastened to a heat sink, a rectangular washer (RCA Part No. NR231A) is recommended to minimize distortion of the mounting flange. Excessive distortion of the flange could cause damage to the package. The washer is particularly important when the size of the mounting hole exceeds 0.140 inch (6-32 clearance). Larger holes are needed to accommodate insulating bushings; however, the holes should not be larger than necessary to provide hardware clearance and, in any case, should not exceed a diameter of 0.250 inch.

Operating Considerations

Flange distortion is also possible if excessive torque is used during mounting. A maximum torque of 8 inch-pounds is specified. Care should be exercised to assure that the tool used to drive the mounting screw never comes in contact with the plastic body during the driving operation. Such contact can result in damage to the plastic body and internal device connections. An excellent method of avoiding this problem is to use a spacer or combination spacer-isolating bushing which raises the screw head or nut above the top surface of the plastic body. The material used for such a spacer or spacer-isolating bushing should, of course, be carefully selected to avoid "cold flow" and consequent reduction in mounting force. Suggested materials for these bushings are diallphtalate, fiberglass-filled nylon, or fiberglass-filled polycarbonate. Unfilled nylon should be avoided.

Modification of the flange can also result in flange distortion and should not be attempted. The package should not be soldered to the heat sink by use of lead-tin solder because the heat required with this type of solder will cause the junction temperature of the device to become excessively high.

The TO-220AA plastic package can be mounted in commercially available TO-66 sockets, such as UID Electronics Corp. Socket No. PTS-4 or equivalent. For testing purposes, the TO-220AB in-line package can be mounted in a Jetron Socket No. DC74-104 or equivalent. Regardless of the mounting method, the following precautions should be taken:

1. Use appropriate hardware.
2. Always fasten the package to the heat sink before the leads are soldered to fixed terminals.
3. Never allow the mounting tool to come in contact with the plastic case.
4. Never exceed a torque of 8 inch-pounds.
5. Avoid oversize mounting holes.
6. Provide strain relief if there is any probability that axial stress will be applied to the leads.
7. Use insulating bushings to prevent hot-creep problems. Such bushings should be made of diallphthalate, fiberglass-filled nylon, or fiberglass-filled polycarbonate.

The maximum allowable power dissipation in a solid state device is limited by the junction temperature. An important factor in assuring that the junction temperature remains below the specified maximum value is the ability of the associated thermal circuit to conduct heat away from the device.

When a solid state device is operated in free air, without a heat sink, the steady-state thermal circuit is defined by the junction-to-free-air thermal resistance given in the published data for the device. Thermal considerations require that a free flow of air around the device is always present and that the power dissipation be maintained below the level which would cause the junction temperature to rise above the maximum rating. However, when the device is mounted on a heat sink, care must be taken to assure that all portions of the thermal circuit are considered.

To assure efficient heat transfer from case to heat sink when mounting RCA molded-plastic solid state power devices, the following special precautions should be observed:

1. Mounting torque should be between 4 and 8 inch-pounds.
2. The mounting holes should be kept as small as possible.
3. Holes should be drilled or punched clean with no burrs or ridges, and chamfered to a maximum radius of 0.010 inch.
4. The mounting surface should be flat within 0.002 inch/inch.
5. Thermal grease (Dow Corning 340 or equivalent) should always be used on both sides of the insulating washer if one is employed.
6. Thin insulating washers should be used. (Thickness of factory-supplied mica washers range from 2 to 4 mils).
7. A lock washer or torque washer, made of material having sufficient creep strength, should be used to prevent degradation of heat sink efficiency during life.

A wide variety of solvents is available for degreasing and flux removal. The usual practice is to submerge components in a solvent bath for a specified time. However, from a reliability stand point it is extremely important that the solvent, together with other chemicals in the solder-cleaning system (such as flux and solder covers), do not adversely affect the life of the component. This consideration applies to all non-hermetic and molded-plastic components.

It is, of course, impractical to evaluate the effect on long-term device life of all cleaning solvents, which are marketed with numerous additives under a variety of brand names. These solvents can, however, be classified with respect to their component parts as either acceptable or unacceptable. Chlorinated solvents tend to dissolve the outer package and, therefore, make operation in a humid atmosphere unreliable. Gasoline and other hydrocarbons cause the inner encapsulant to swell and damage the transistor. Alcohol is an acceptable solvent. Examples of specific, acceptable alchols are isopropanol, methanol, and special denatured alcohols, such as SDA1, SDA30, SDA34, and SDA44.

Under certain conditions, dimethyl silicone fluids may react chemically with the encapsulant of plastic devices and cause damage to the package. These fluids do not cause damage when they are contained in materials such as thermal compounds. These fluids, however, are unacceptable for use as baths or encapsulants for plastic-package devices. In addition, plastic-package devices should not be used or stored in environments that contain significant amounts of dimethyl silicone fluid.

Care must also be used in the selection of fluxes for lead soldering. Rosin or activated rosin fluxes are recommended, while organic or acid fluxes are not. Examples of acceptable fluxes are:

1. Alpha Reliaros No. 320-33
2. Alpha Reliaros No. 346
3. Alpha Reliaros No. 711
4. Alpha Reliafoam No. 807
5. Alpha Reliafoam No. 809
6. Alpha Reliafoam No. 811-13
7. Alpha Reliafoam No. 815-35
8. Kester No. 44

If the completed assembly is to be encapsulated, the effect on the molded-plastic transistor must be studied from both a chemical and a physical standpoint.

RECTIFIERS AND THYRISTORS

A surge-limiting impedance should always be used in series with silicon rectifiers and thyristors. The impedance value must be sufficient to limit the surge current to the value specified under the maximum ratings. This impedance may be provided by the power transformer winding, or by an external resistor or choke.

A very efficient method for mounting thyristors utilizing the "modified TO-5" package is to provide intimate contact between the heat sink and at least one half of the base of the device opposite the leads. This package can be mounted to the heat sink mechanically with glue or an expoxy adhesive, or by soldering, the most efficient method.

The use of a "self-jigging" arrangement and a solder preform is recommended. If each unit is soldered individually, the heat source should be held on the heat sink and the solder on the unit. Heat should be applied only long enough to permit solder to flow freely. For more detailed thyristor mounting considerations, refer to Application Note AN3822, "Thermal Considerations in Mounting of RCA Thyristors".

RF POWER TRANSISTORS

Mounting and Handling

Stripline rf devices should be mounted so that the leads are not bent or pulled away from the stud (heat sink) side of the device. When leads are formed, they should be supported to avoid transmitting the bending or cutting stress to the ceramic portion of the device. Excessive stresses may destroy the hermeticity of the package without displaying visible damage.

Devices employing silver leads are susceptible to tarnishing; these parts should not be removed from the original tarnish-preventive containers and wrappings until ready for use. Lead solderability is retarded by the presence of silver tarnish; the tarnish can be removed with a silver cleaning solution, such as thiourea.

The ceramic bodies of many rf devices contain beryllium oxide as a major ingredient. These portions of the transistors should not be crushed, ground, or abraded in any way because the dust created could be hazardous if inhaled.

Operating

Forward-Biased Operation. For Class A or AB operation, the allowable quiescent bias point is determined by reference to the infrared safe-area curve in the appropriate data bulletin. This curve depicts the safe current/voltage combinations for extended continuous operation.

Load VSWR. Excessive collector load or tuning mismatch can cause device destruction by over-dissipation or secondary breakdown. Mismatch capability is generally included on the data bulletins for the more recent rf transistors.

See RCA RF Power Transitor Manual, Technical Series RMF-430, pp 39-41, for additional information concerning the handling and mounting of rf power transistors.

SOLID STATE CHIPS

Solid state chips, unlike packaged devices, are non-hermetic devices, normally fragile and small in physical size, and therefore, require special handling considerations as follows:

1. Chips must be stored under proper conditions to insure that they are not subjected to a moist and/or contaminated atmosphere that could alter their electrical, physical, or mechanical characteristics. After the shipping container is opened, the chip must be stored under the following conditions:
   - A. Storage temperature, 40°C max.
   - B. Relative humidity, 50% max.
   - C. Clean, dust-free environment.
2. The user must exercise proper care when handling chips to prevent even the slightest physical damage to the chip.
3. During mounting and lead bonding of chips the user must use proper assembly techniques to obtain proper electrical, thermal, and mechanical performance.
4. After the chip has been mounted and bonded, any necessary procedure must be followed by the user to insure that these non-hermetic chips are not subjected to moist or contaminated atmosphere which might cause the development of electrical conductive paths across the relatively small insulating surfaces. In addition, proper consideration must be given to the protection of these devices from other harmful environments which could conceivably adversely affect their proper performance.

Terms and Symbols

General

AQL	acceptance quality level
CM	cross modulation
IMD	intermodulation distortion
K	post-radiation neutron-damage constant
LTPD	lot tolerance per cent defective
MTBF	mean time between failures
MTTF	mean time to failure
NF	noise factor (or noise figure)
P_D	device dissipation
pps	pulses per second
P_{rr}	pulse repetition rate
prt	pulse recurrence time
PW	pulse width
RMS	root mean square
$R_{\theta JA}$	thermal resistance, junction-to-ambient
$R_{\theta JC}$	thermal resistance, junction-to-case
$R_{\theta JF}$	thermal resistance, junction-to-flange
$R_{\theta JFA}$	thermal resistance, junction-to-free air
$R_{\theta JHS}$	thermal resistance, junction-to-heat sink
T_A	ambient temperature
T_C	case temperature
THD	total harmonic distortion
T_J	operating (junction) temperature
T_L	lead temperature during soldering
t_p	pulse duration
T_{stg}	storage temperature
η	efficiency
θ	conduction angle
ϕ	phase angle
ϕL	lead radius (for bending)
τ	torque
τ_s	device stud torque

Power Transistors

(C)	collector-to-base charge-generation constant (during gamma exposure)
$C_{b'c}$	feedback capacitance
C_c	collector-to-case capacitance
C_{cb}	collector-to-base feedback capacitance
C_{ib}	common-base input capacitance
C_{ob}	common-base output capacitance
C_{obo}	open-circuit common-base output capacitance
$E_{S/b}$	reverse-bias second-breakdown energy
$f_{\alpha b}$	base (alpha) cutoff frequency
$f_{\alpha e}$	emitter (beta) cutoff frequency
h_{FE}	dc forward-current transfer ratio
h_{fe}	common-emitter, small-signal, short-circuit, forward-current transfer ratio
$\lvert h_{fe} \rvert$	magnitude of common-emitter, small-signal, short-circuit, forward-current transfer ratio
f_{hfe}	common-emitter, small-signal, short-circuit forward-current transfer ratio cutoff frequency
f_T	gain-bandwidth product (unity-gain frequency for devices in which gain roll off has a −1 slope)
G_c	conversion gain
G_{pb}	small-signal, common-base power gain
G_{PB}	large-signal, common-base power gain
G_{pe}	small-signal, common-emitter power gain
G_{PE}	large-signal, common-emitter power gain
G_{VE}	wide-band voltage gain
h_{ib}	common-base, small-signal, short-circuit input impedance
h_{ie}	common-emitter, small-signal, short-circuit input impedance
h_{ob}	common-base, small-signal, open circuit output admittance
h_{rb}	common-base, small-signal, open-circuit reverse-voltage transfer ratio
I_B	continuous base current
I_{BEV}	base-cutoff current with specified voltage between collector and emitter
I_{BM}	peak base current
I_C	continuous collector current
I_{CBO}	collector-cutoff current, emitter open
I_{CEO}	collector-cutoff current, base open
I_{CER}	collector-cutoff current with specified resistance between base and emitter
I_{CES}	collector-cutoff current with base-emitter junction short-circuited
I_{CEV}	collector-cutoff current with specified voltage between base and emitter
I_{CEX}	collector-cutoff current with specified circuit between base and emitter
I_{CM}	peak collector current
I_E	continuous emitter current
I_{EBO}	emitter-cutoff current, collector open
I_{EM}	peak emitter current
$I_{S/b}$	forward-bias, second-breakdown collector current
P_G	power gain
PRT	power rating test
P_T	transistor dissipation at specified temperature
$r_{bb'}$	base spreading resistance
R_{BB}	base bias resistor
$r_b'C_c$	collector-to-base time constant
R_{BE}	external base-to-emitter resistance
R_C	collector resistor
$r_{CE}(sat)$	dc collector-to-emitter saturation resistance
$Re(h_{ie})$	real part of common-emitter, small-signal, short-circuit input impedance
R_s	collector-to-emitter saturation resistance
t_c	clamped inductive fall time
t_d	delay time
t_f	fall time
t_{OFF}	turn-off time (storage time + fall time)
t_{ON}	turn-on time (delay time + rise time)
t_r	rise time
t_s	storage time
T_{VI}	clamped inductive turn-off time
V_{BB}	base supply voltage

Terms and Symbols

Power Transistors (Cont'd)

V_{BE}	base-to-emitter voltage
$V_{BE}(\text{sat})$	base-to-emitter saturation voltage
$V_{(BR)CBO}$	collector-to-base breakdown voltage, emitter open
$V_{(BR)CEO}$	collector-to-emitter breakdown voltage, base open
$V_{(BR)CEV}$	collector-to-emitter breakdown voltage with specified voltage between base and emitter
$V_{(BR)CEX}$	collector-to-emitter breakdown voltage with specified circuit between base and emitter
$V_{(BR)EBO}$	emitter-to-base breakdown voltage, collector open
V_{CB}	collector-to-base voltage
V_{CBO}	collector-to-base voltage, emitter open
V_{CC}	collector supply voltage
V_{CE}	collector-to-emitter voltage
V_{CEO}	collector-to-emitter voltage, base open
$V_{CE}(\text{sat})$	collector-to-emitter saturation voltage
$V_{CEO}(\text{sus})$	collector-to-emitter sustaining voltage, base open
V_{CER}	collector-to-emitter voltage with specified resistance between base and emitter
$V_{CER}(\text{sus})$	collector-to-emitter sustaining voltage with specified resistance between base and emitter
V_{CES}	collector-to-emitter voltage with base-emitter junction short-circuited
V_{CEV}	collector-to-emitter voltage with specified voltage between base and emitter
$V_{CEV}(\text{sus})$	collector-to-emitter sustaining voltage with specified voltage between base and emitter
V_{CEX}	collector-to-emitter voltage with specified circuit between base and emitter
$V_{CEX}(\text{sus})$	collector-to-emitter sustaining voltage with specified circuit between base and emitter
V_{EB}	emitter-to-base voltage
V_{EBO}	emitter-to-base voltage, collector open
V_F	diode forward-voltage drop
V_{RT}	collector-to-emitter reach-through (or punch through) voltage
α	common-base current gain (alpha)
β	collector-emitter current gain (beta)
η_C	collector efficiency
τ_I	thermal time constant

Power Hybrid Operational Amplifiers

A	voltage gain
A_{CL}	closed-loop voltage gain
A_{OL}	open-loop voltage gain
CMRR	common-mode rejection ratio
f_H	closed-loop bandwidth
I_i	idling current
I_{IB}	input bias current
I_{IO}	input offset current
I_o	quiescent current
I_{om}	maximum peak quiescent current
I_S	short-circuit current
P_T	total power dissipation for each output transistor
R_{em}	common-mode input impedance
S/N	signal-to-noise ratio
SR	slew rate
V_{ICR}	common-mode input voltage range
V_{IN}	input signal voltage swing
V_{IO}	input offset voltage
V_{offset}	offset voltage
V_{OUT}	output voltage swing
V_{OUT}/V_{IN}	voltage gain
V_{RR}	supply-voltage ripple rejection ratio
V_S	supply voltage
Z_{IN}	input impedance
ΔI_i	idling-current drift

Silicon Rectifiers

I_F	forward current
$I_{F(AV)}$	average forward current
$I_{F(RMS)}$	rms forward current
I_{FM}	maximum (peak) forward current
I_{FRM}	repetitive peak forward current
I_{FSM}	peak surge (nonrepetitive) forward current
I_o	average forward current, 180-degree conduction angle, half-sine wave
I_R	reverse current
$I_{R(AV)}$	average dynamic reverse current, single-phase, full-cycle
I_{RM}	maximum (peak) reverse current
I_{rr}	reverse recovery current
I^2t	amperes squared-seconds (fusing current for rectifier protection)
P_F	forward power dissipation
$P_{F(AV)}$	average forward power dissipation
P_{FM}	maximum (peak) forward power dissipation
P_R	reverse power dissipation
R_s	surge-limiting resistance
t_{rr}	reverse recovery time
V_F	forward voltage drop
v_F	instantaneous forward voltage drop
V_R	reverse (dc blocking) voltage
$V_{R(RMS)}$	RMS reverse voltage
V_{RRM}	repetitive peak reverse voltage
V_{RSM}	nonrepetitive peak reverse voltage
V_{RWM}	working peak reverse voltage

Thyristors (Triacs, SCR's, GTO's, and ITR's) and Diacs

di/dt	rate of change of on-state current
di_F/dt	rate of change of forward current (rectifier unit of ITR)
dv/dt	critical rate of rise of off-state voltage
$I_{(BO)}$	peak breakover current
i_D	instantaneous off-state current
i_{DO}	instantaneous off-state current, gate open
I_{DOM}	maximum (peak) off-state current, gate open
I_{DROM}	maximum peak (repetitive) off-state current, gate open
I_{DRX}	dc off-state current, specified circuit between gate and cathode

Terms and Symbols

Thyristors (Triacs, SCR's, GTO's, and ITR's and Diacs) (Cont'd)

I_{DRXM}	maximum (peak) repetitive dc off-state current with specified circuit between gate and cathode
I_{DXM}	maximum (peak) off-state current, specified circuit between gate and cathode
i_F	instantaneous forward current
I_{FM}	peak forward current
I_{FRM}	peak repetitive forward current
I_{FSM}	peak surge forward current (nonrepetitive)
I_G	dc gate current
I_g	pulsed gate trigger current (gate drive current)
I_{ggM}	maximum gate turn-off current
I_{GM}	maximum (peak) gate current
$I_{GR(BR)}$	reverse gate breakdown current
I_{GRRM}	maximum (peak) reverse gate current
I_{GT}	dc gate trigger current
i_{HO}	instantaneous holding current, gate open
I_{HO}	dc holding current, gate open
i_L	instantaneous latching current
I_L	dc latching current
I_o	average dc forward current
I_R	dc reverse current
i_R	instantaneous reverse current
i_{RO}	instantaneous reverse current, gate open
I_{RM}	maximum (peak) reverse current
I_{RROM}	maximum (peak) reverse current, gate open
I_{RRX}	dc reverse current, specified circuit between gate and cathode
I_{RRXM}	maximum (peak) reverse current, specified circuit between gate and cathode
I^2t	amperes squared-seconds (fusing current for device protection)
i_T	instantaneous on-state current
I_T	dc on-state current
I_{TGQM}	maximum (peak) on-state current gate-turn-off capability
$I_{T(AV)}$	average on-state current

I_{TM}	maximum (peak) on-state current
$I_{TM(pulse)}$	maximum (peak) pulse on-state current
$I_{T(RMS)}$	rms on-state current
I_{TRXM}	maximum (peak) (repetitive) on-state current, specified operating circuit
I_{TSM}	maximum (peak) surge (non-repetitive) on-state current
I_{TXM}	maximum (peak) on-state current, specified operating circuit
P_D	device dissipation
$P_{D(AV)}$	average device dissipation
$P_{G(AV)}$	average gate power dissipation
P_{GM}	maximum (peak) gate power dissipation
P_{GRM}	maximum (peak) reverse gate power
P_T	on-state power dissipation
$P_{T(AV)}$	average on-state power dissipation
t_d	delay time
t_f	fall time
t_{gq}	gate controlled turn-off time $(t_s + t_f)$
$t_{g(rec)}$	gate recovery time
t_{gt}	gate controlled turn-on time $(t_d + t_r)$
t_q	circuit commutated turn-off time $(t_{rr} + t_{g(rec)})$
t_r	rise time
t_{rr}	reverse recovery time
t_s	storage time
$V_{(BO)}$	breakover voltage
$\lvert +V_{(BO)}\rvert - \lvert -V_{(BO)}\rvert$	breakover voltage symmetry (for diacs)
$v_{(BO)O}$	instantaneous breakover voltage, gate open
V_D	dc off-state voltage
v_D	instantaneous off-state voltage
V_{DM}	maximum (peak) dc off-state voltage
V_{DROM}	maximum (peak) (repetitive) off-state voltage, gate open
V_{DRXM}	maximum (peak) (repetitive) off-state voltage, specified circuit between gate and cathode
V_{DSOM}	maximum (peak) (nonrepetitive) off-state voltage, gate open
V_{DSXM}	maximum (peak) (nonrepetitive) off-state voltage, specified circuit between gate and cathode

v_{DX}	instantaneous off-state voltage, specified circuit between gate and cathode
V_{DX}	dc off-state voltage, specified circuit between gate and cathode
v_F	instantaneous forward voltage drop
V_{FM}	maximum (peak) forward voltage
V_G	dc gate voltage
V_{GK}	dc gate-to-cathode voltage
V_{gq}	gate turn-off voltage
V_{GR}	dc reverse gate voltage
$V_{GR(BR)}$	reverse gate breakdown voltage
V_{GRM}	maximum (peak) gate reverse voltage
V_{GRRM}	Maximum (peak) repetitive reverse gate voltage
V_{GT}	dc gate trigger voltage
V_R	dc reverse voltage
V_{RROM}	maximum (peak) (repetitive) reverse voltage, gate open
V_{RRXM}	maximum (peak) (repetitive) voltage, specified circuit between gate and cathode
V_{RSOM}	maximum (peak) (nonrepetitive)reverse voltage, gate open
V_{RSXM}	maximum (peak) (nonrepetitive) reverse voltage, specified circuit between gate and cathode
V_{RX}	dc reverse voltage, specified circuit between gate and cathode
V_{RXM}	maximum (peak) reverse voltage, specified circuit between gate and cathode
v_T	instantaneous on-state voltage
V_T	dc on-state voltage
$v_{T(I)}$	initial on-state voltage
V_{TM}	maximum (peak) dc on-state voltage
Z_{GS}	gate source impedance
$\Delta V \pm$	dynamic breakback voltage

Power Transistors

Technical Data

2N697, 2N699, 2N1613, 2N1711, 2N1893, 2N2102, 2N2270, 2N2405, 2N3053, 2N3053A, 40366, 40389, 40392, 41502

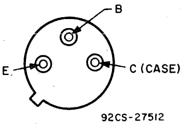
Low-Power Silicon N-P-N Planar Transistors

For Small-Signal Applications In Industrial and Commercial Equipment

These RCA types are silicon n-p-n planar transistors intended for a variety of small-signal and medium-power applications. They feature exceptionally high collector-to-emitter sustaining voltage, low leakage characteristics, high switching speeds, and high pulse beta (h_{FE}).

RCA-2N2102 is a direct replacement for the 2N1613. RCA-2N2405 is a direct replacement for the 2N1893. All of these devices are supplied in the JEDEC TO-39 hermetic package.

TERMINAL DESIGNATIONS



JEDEC TO-39

Features:

- Planar construction for low noise and low leakage
- Low output capacitance
- Low saturation voltages

Additional Features for 40366:

- High reliability assured by five pre-conditioning steps
- Group A test data included in data sheet.

									2N3053			
				2N2102	2N1613				40389			
Maximum Ratings, *Absolute-Maximum Values:*		2N697	2N699	40366	2N1711	2N1893	2N2270	2N2405	40392	2N3053A	41502	
* COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	60	120	120	75	120	60	120	60	80	–	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:												
With external base-to-emitter resistance (R_{BE}) $\leqslant 10\ \Omega$	$V_{CER}(sus)$	–	80	80	50	100	60	140	50	70	–	V
With base-emitter junction reverse-biased	$V_{CEV}(sus)$	–	–	–	–	120	–	120	60	80	–	V
* With base open	$V_{CEO}(sus)$	–	–	65	–	80	45	90	40	60	30	V
* EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	5	7	7	7	7	7	5	5	4	V
* COLLECTOR CURRENT	I_C	0.5	1	1	1	0.5	1	1	0.7	0.7	1	A
* TRANSISTOR DISSIPATION:	P_T											
At case temperatures up to 25°C		2	2	5	3	3	5	5	5●	5	3	W
At free-air temperatures up to 25°C		0.6	0.6	1	0.8	0.8	1	1	1■	1	0.8	W
At temperatures above 25°C		Derate linearly to maximum temperature										
* TEMPERATURE RANGE:												
Storage	T_{stg}	–65 to +175		–65 to 200								°C
Operating (Junction)	T_C	–65 to +175		–65 to 200								°C
* LEAD TEMPERATURE (During soldering):												
At distance from seating plane for 10 s max. $\geqslant$ 1/16 in. (1.58 mm)	T_L	255	230	300	300	255	230	255	235	235	300	°C

* 2N-Series types in accordance with JEDEC registration data

●7 for 40392. ■3.5 for 40389

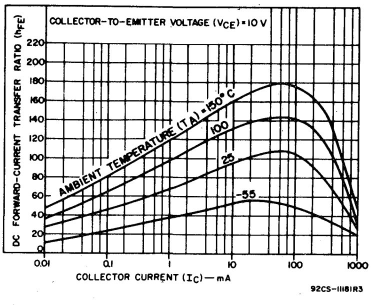


Fig. 1 - Typical dc beta characteristics for 2N699, 2N1613, 2N2102, 2N2270, 41502.

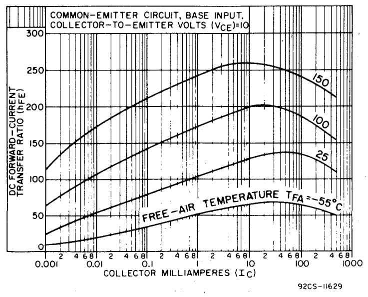


Fig. 2 - Typical dc beta characteristics for 2N1711.

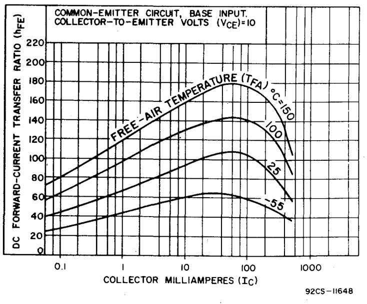


Fig. 3 - Typical dc beta characteristics for 2N1893, 2N2405.

2N697, 2N699, 2N1613, 2N1711, 2N1893, 2N2102 , 2N2270, 2N2405, 2N3053, 2N3053A, 40366, 40389, 40392, 41502

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS											UNITS
		VOLTAGE V dc		CURRENT mA dc		2N697			2N699		2N1613		2N2102 40366		2N1711		
		V_{CB}	V_{CE}	I_C	I_B	MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
* Collector Cutoff Current:		30				—	0.01	1	—	—	—	—	—	—	—	—	
With emitter open	I_{CBO}	60				—	—	—	—	0.05	—	0.01	—	0.002	—	0.01	μA
At T_C = 150°C		60				—	—	—	—	—	—	10	—	2	—	10	
* Emitter Cutoff Current: V_{EB} = 5 V	I_{EBO}			0		—	—	—	—	0.05	—	0.01	—	0.002	—	0.005	μA
* DC Forward-Current Transfer Ratio	h_{FE}		10	0.01		—	—	—	—	—	—	—	10	—	20	—	
			10	0.1		—	—	—	—	—	20	—	20	—	35	—	
			10	10[a]		—	—	—	—	—	35	—	35	—	75	—	
			10	150[a]		40	—	120	40	120	40	120	40	120	100	300	
			10	500[a]		—	—	—	—	—	20	—	25	—	40	—	
At T_C = −55°C			10	10[a]		—	—	—	—	—	20	—	20	—	35	—	
* Collector-to-Emitter Reachthrough Voltage: V_{EB} = 1.5 V, I_E = 0	V_{RT}					—	—	—	—	—	—	—	120	—	75	—	V
* Collector-to-Base Breakdown Voltage: With emitter open	$V_{(BR)CBO}$			0.1		60	75	—	120	—	75	—	120	—	75	—	V
* Emitter-to-Base Breakdown Voltage: I_E = 0.1 mA	V(BR)EBO			0		5	7.5	—	—	—	7	—	7	—	7	—	V
* Collector-to-Emitter Sustaining Voltage: With base open	V_{CEO}(sus)			100[a]	0	—	—	—	—	—	—	—	65	—	—	—	V
With external base-to-emitter resistance (R_{BE}) = 10 Ω	V_{CER}(sus)			100[a]		40	60	—	80	—	50	—	80	—	50	—	V
* Base-to-Emitter Saturation Voltage	V_{BE}(sat)			150[a]	15	—	1	1.3	—	1.3	—	1.3	—	1.1	—	1.3	V
* Collector-to-Emitter Saturation Voltage	V_{CE}(sat)			150[a]	15	—	0.7	1.5	—	5	—	1.5	—	0.5	—	1.5	V
* Common-Emitter, Small-Signal, Forward-Current Transfer Ratio (f = 1 kHz)	h_{fe}		5	1		—	—	—	35	100	30	100	30	100	50	200	
			10	5		—	—	—	45	—	35	150	35	150	70	300	
Magnitude of Common-Emitter, Small-Signal, Forward Current Transfer Ratio (f = 20 MHz)	$\|h_{fe}\|$		10	50		2.5	5	—	2.5	—	3	—	3	—	3.5	—	
* Input Resistance: f = 1 kHz	h_{ib}	5		1		—	—	—	20	30	24	34	24	34	24	34	Ω
		10		5		—	—	—	—	10	4	8	4	8	4	8	
* Small-Signal Reverse Voltage Transfer (Feedback) Ratio: f = 1 kHz	h_{rb}	5		1		—	—	—	—	3×10^{-4}	—	3×10^{-4}	—	3×10^{-4}	—	5×10^{-4}	
		10		1		—	—	—	—	—	—	3×10^{-4}	—	—	—	—	
		10		5		—	—	—	—	3×10^{-4}	—	—	—	3×10^{-4}	—	5×10^{-4}	
* Output Conductance: f = 1 kHz	h_{ob}	5		1		—	—	—	0.05	0.5	0.05	0.5	0.01	0.5	0.05	0.5	μmho
		10		5		—	—	—	—	1	0.05	0.5	0.01	1	0.05	0.5	
* Output Capacitance: I_E = 0	C_{ob}	10				—	20	35	—	20	—	25	—	15	—	25	pF
* Input Capacitance: V_{EB} = 0.5 V	C_{ib}			0		—	—	—	—	—	—	80	—	80	—	80	pF
Gain-Bandwidth Product	f_T					50	100	—	50	—	60	—	60	—	70	—	MHz
* Noise Figure: Circuit Bandwidth (BW) = 1 Hz Reference signal freq. = 1 kHz Generator resistance (R_G) =	NF	10		0.3													dB
510 Ω (2N1613, 2N1711)						—	—	—	—	—	—	12	—	—	—	8	
1 KΩ (2N2102)						—	—	—	—	—	—	—	—	6	—	—	
* Saturated Switching Time	$t_d+t_r+t_f$					—	—	—	—	—	—	30	—	30	—	—	ηs
Thermal Resistance: Junction-to-case	$R_{\theta JC}$					—	—	75	—	75*	—	58.3*	—	35*	—	58.3*	°C/W
Junction-to-ambient	$R_{\theta JA}$					—	—	250	—	250*	—	219*	—	175*	—	219*	

*2N-Series types in accordance with JEDEC registration data

[a] Pulsed, pulse duration = 300 μs, duty factor = 2% (1.8% for 2N2102 only).

2N697, 2N699, 2N1613, 2N1711, 2N1893, 2N2102, 2N2270, 2N2405, 2N3053, 2N3053A, 40366, 40389, 40392, 41502

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified.*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS												UNITS
		VOLTAGE V dc		CURRENT mA dc		2N1893		2N2405		2N2270		2N3053 40389 40392		2N3053A		41502		
		V_{CB}	V_{CE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX	
* Collector Cutoff Current:		15				–	–	–	–	–	–	–	–	–	–	–	2	
With emitter open	I_{CBO}	30				–	–	–	–	–	–	–	0.25	–	–	–	–	μA
		60				–	–	–	–		0.05	–	–	–	–	–	–	
		90				–	0.01	–	0.01	–	–	–	–	–	–	–	–	
At T_C = 150°C		60				–	–	–	–	–	50	–	–	–	–	–	–	
		90				–	15	–	10	–	–	–	–	–	–	–	–	
* Emitter Cutoff Current: V_{EB} = 5 V, (4 V for 2N3053, 2N3053A)	I_{EBO}			0		–	0.01	–	0.01	–	0.1	–	0.25	–	0.25	–	–	μA
* DC Forward-Current Transfer Ratio	h_{FE}		10	0.1		–	–	20	–	–	–	–	–	–	–	–	–	
			10	1		–	–	–	–	30	–	–	–	–	–	–	–	
			10	10^a		35	–	35	–	–	–	–	–	–	–	–	–	
			10	150^a		40	120	60	200	50	200	50	250	50	250	20	–	
At T_C = 55°C			10	10^a		20	–	20	–	–	–	–	–	–	–	–	–	
* Collector-to-Base Breakdown Voltage: With emitter open	$V_{(BR)CBO}$			0.1		120	–	120	–	60	–	60	–	80	–	–	–	V
* Emitter-to-Base Breakdown Voltage: I_E = 0.1 mA	$V_{(BR)EBO}$			0		7	–	7	–	7	–	5	–	5	–	4	–	V
* Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$			100^a	0	–	–	90	–	45	–	40	–	–	–	–	–	
				30^a		80	–	90	–	–	–	–	–	–	–	30	–	V
				0.1^a	0	–	–	–	–	–	–	–	–	60	–	–	–	
With external base-to-emitter resistance (R_{BE}) = 10Ω	$V_{CER}(sus)$			100^a		100	–	140	–	60	–	50	–	70	–	–	–	V
= 500Ω				100^a		–	–	120	–	–	–	–	–	–	–	–	–	
* Base-to-Emitter Saturation Voltage	$V_{BE}(sat)$			150^a	15	–	1.3	–	1.1	–	0.9	–	1.4	0.6	1	–	–	V
				50^a	5	–	0.9	–	0.9	–	–	–	–	–	–	–	–	
* Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$			150^a	15	–	5	–	0.5	–	1.2	–	1.7	–	0.3	–	1.5	V
				50^a	5	–	1.3	–	0.2	–	–	–	–	–	–	–	–	
Base-to-Emitter Voltage	V_{BE}		2.5	150		–	–	–	–	–	–	–	1.7	–	1	–	–	V
			10	150^a		–	–	–	–	–	–	–	–	–	–	–	2.5	
* Common Emitter, Small-Signal, Forward Current Transfer Ratio	h_{f_e}																	
* f = 1 kHz			5	1		30	100	–	–	–	–	–	–	–	–	–	–	
* = 1 kHz			5	5		–	–	50	275	5	–	–	–	–	–	–	–	
* = 1 kHz			10	5		45	–	–	–	5	275	–	–	–	–	–	–	
= 20 MHz			10	50		2.5*	–	6	–	5*	–	5*	–	5	–	–	–	
* Input Resistance: f = 1 kHz	h_{ib}	5		1		20	30	24	34	–	–	–	–	–	–	–	–	Ω
		10		5		4	8	4	8	–	–	–	–	–	–	–	–	
* Small Signal Reverse Voltage Transfer (Feedback) Ratio: f = 1 kHz	h_{rb}	5		1		–	1.25×10^{-4}	–	3×10^{-4}	–	–	–	–	–	–	–	–	
		10		5		–	1.25×10^{-4}	–	3×10^{-4}	–	–	–	–	–	–	–	–	
* Output Conductance: f = 1 kHz	h_{ob}	5		1		–	0.5	–	0.5	–	–	–	–	–	–	–	–	μmho
		10		5		–	0.5	–	0.5	–	–	–	–	–	–	–	–	
* Output Capacitance: I_E = 0	C_{ob}	10				–	15	–	15	–	15	–	15	–	15	–	25	pF
* Input Capacitance: V_{EB} = 0.5 V	C_{ib}			0		–	85	–	85	–	80	–	80	–	80	–	80	pF
Gain-Bandwidth Product	f_T					50	–	120	–	100	–	100	–	100	–	–	–	MHz
Noise Figure: Circuit Bandwidth (BW) = 1 Hz Reference signal freq. = 1 kHz Generator resistance (R_G) = 500 Ω (2N2405) 1 kΩ (2N2270)	NF	10		0.3		–	–	–	6	–	10*	–	–	–	–	–	–	dB
* Saturated Switching Time	$t_d+t_r+t_f$					–	–	–	–	–	30	–	–	–	–	–	–	ηs
Thermal Resistance: Junction-to-case	$R_{\theta JC}$					–	58.3	–	35	–	35	–	35●	–	35	–	58.3	°C/W
Junction-to-ambient	$R_{\theta JA}$					–	219	–	175	–	175	–	175■	–	175	–	219	

* 2N-Series types in accordance with JEDEC registration data.

a Pulsed; pulse duration = 300 μs, duty factor ⩽2%.

2N697, 2N699, 2N1613, 2N1711, 2N1893, 2N2102, 2N2270, 2N2405, 2N3053, 2N3053A, 40366, 40389, 40392, 41502

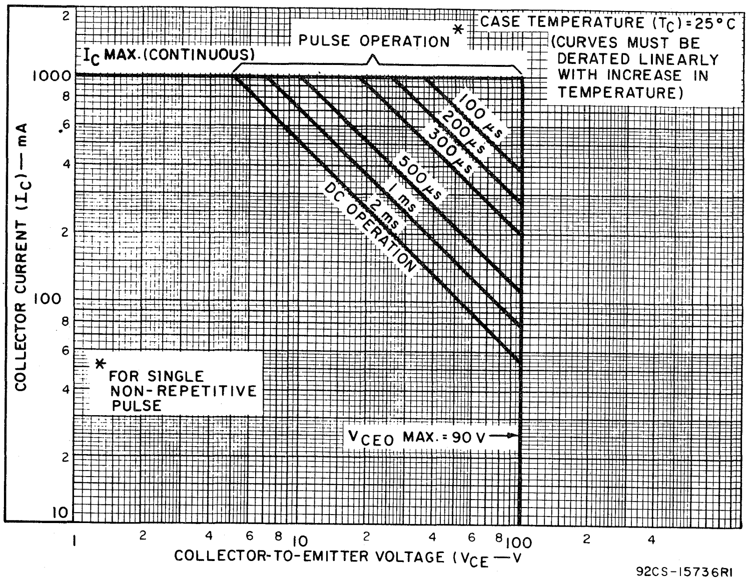


Fig. 4 - Maximum operating areas for 2N2405.

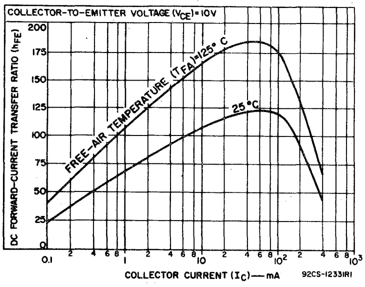


Fig. 6 — Typical dc beta characteristics for 2N3053, 2N3053A, 40389, 40392.

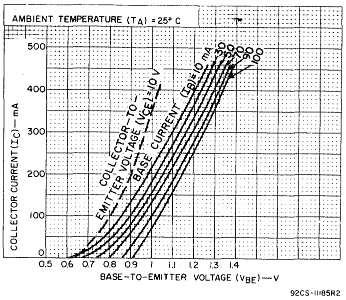


Fig. 7 - Typical transfer characteristics for 2N1613, 2N1711, 2N1893, 2N2102, 2N2405.

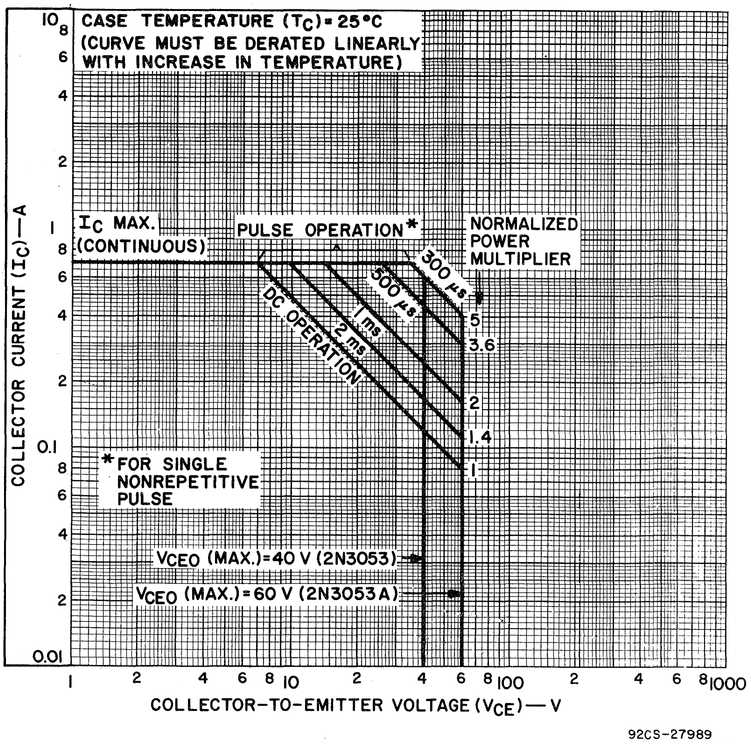


Fig. 5 — Maximum operating areas for 2N3053 and 2N3053A.

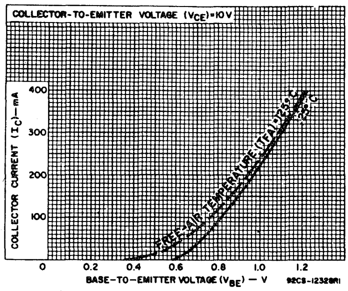


Fig. 8 - Typical transfer characteristics for 2N3053, 2N3053A, 40389, 40392.

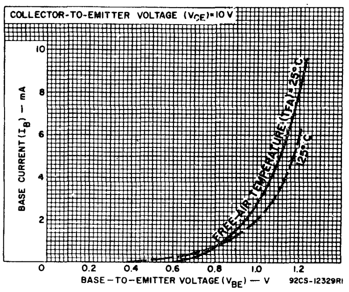


Fig. 9 - Typical input characteristics for 2N3053, 2N3053A, 40389, 40392.

2N697, 2N699, 2N1613, 2N1711, 2N1893, 2N2102, 2N2270, 2N2405, 2N3053, 2N3053A, 40366, 40389, 40392, 41502

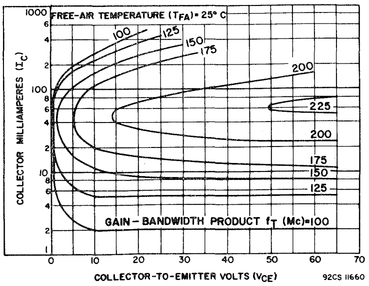


Fig. 10 - Typical gain bandwidth product (f_T) for 2N1711, 2N1893,2N2405.

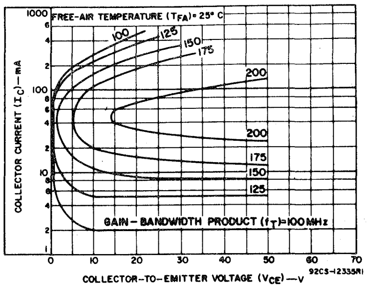


Fig. 11 - Typical gain bandwidth product (f_T) for 2N699, 2N1613, 2N2102, 2N2270, 2N3053, 2N3053A, 40389, 40392.

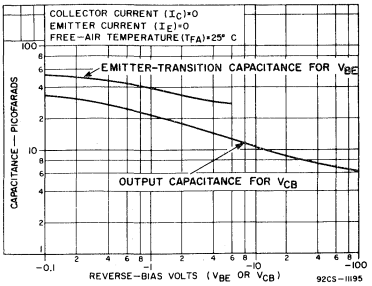


Fig. 12 - Typical capacitance characteristics for all types.

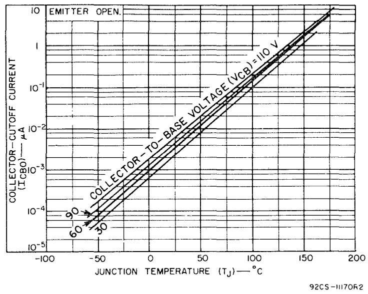


Fig. 13 - Typical collector-cutoff current characteristics for 2N699, 2N1893, 2N2405.

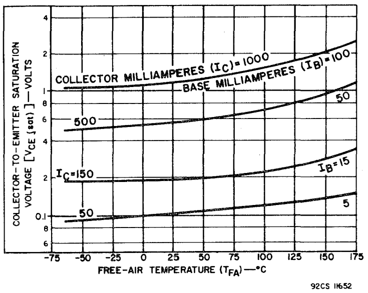


Fig. 14 - Typical collector-to-emitter saturation characteristics for 2N1893, 2N2405.

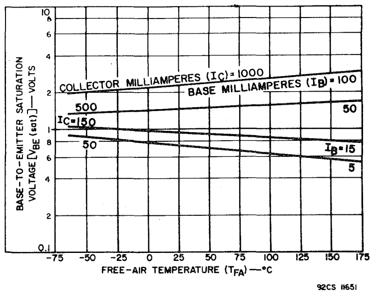


Fig. 15 - Typical base-to-emitter saturation characteristics for 2N1893, 2N2405.

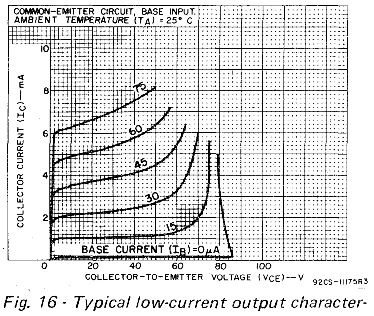


Fig. 16 - Typical low-current output characteristics for 2N699, 2N1613, 2N2102, 2N2270, 41502.

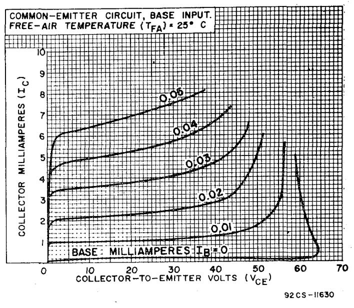


Fig. 17 - Typical low-current output characteristics for 2N1711.

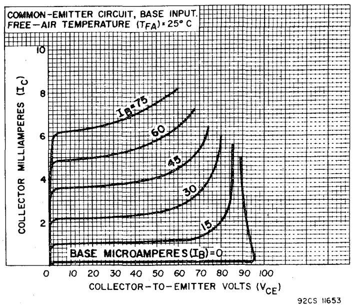


Fig. 18 - Typical low-current output characteristics for 2N1893.

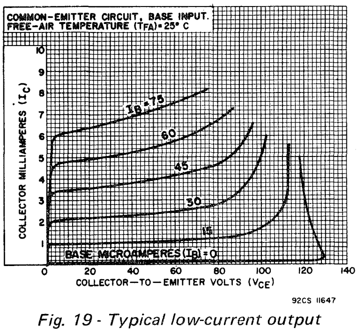


Fig. 19 - Typical low-current output characteristics for 2N2405.

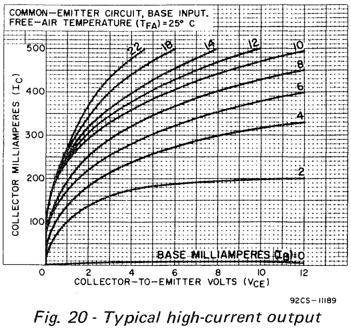


Fig. 20 - Typical high-current output characteristics for 2N699, 2N2270.

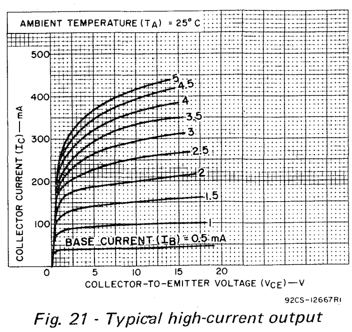


Fig. 21 - Typical high-current output characteristics for 2N1613, 2N2102, 41502.

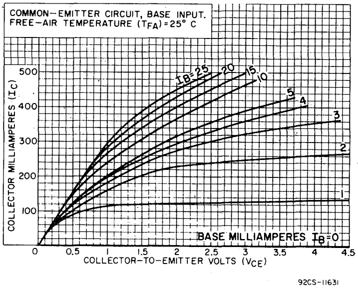


Fig. 22 -Typical high-current output characteristics for 2N1711.

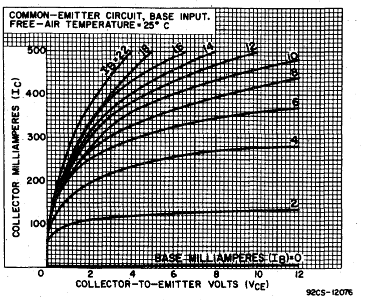


Fig. 23 - Typical high-current output characteristics for 2N1893.

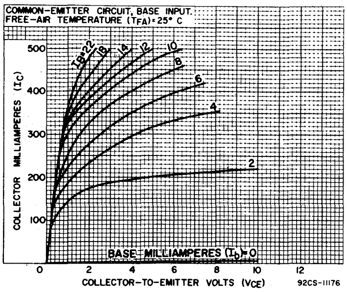


Fig. 24 - Typical high-current output characteristics for 2N2405.

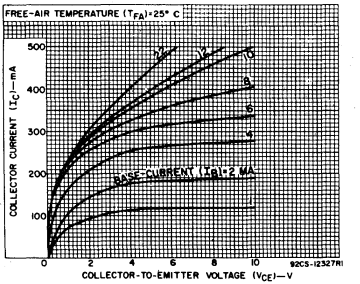


Fig. 25 - Typical high-current output characteristics for 2N3053, 2N3053A, 40389, 40392.

2N1479-2N1482, 2N1700, 40347-40349, 40367
Hometaxial-Base Silicon N-P-N Power Transistors

General-Purpose Types for Low-Power Applications

These RCA types are hometaxial-base, silicon n-p-n power transistors intended for a wide variety of applications in industrial and military equipment. They are particularly useful in power-switching circuits such as in dc-to-dc converters, inverters, choppers, solenoid and relay controls; in oscillator, regulator, and pulse-amplifier circuits; and as class A and class B push-pull audio and servo amplifiers.

The 2N1700 and 40367 are supplied in the hermetic JEDEC TO-39 package or TO-39 with factory-attached mounting flange or heat radiator. Types 2N1479–2N1482 and 40347–40349 are also available in the JEDEC TO-5 package.

Features:

- High-temperature characterization
- High dc beta at 200 mA
- Full switching-time characterization at 200 mA

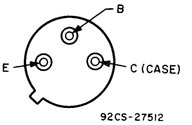
Additional features for 40367:

- High realiability assured by five preconditioning steps
- Group A test data in data bulletin

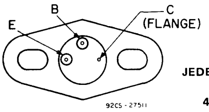
Maximum Ratings, *Absolute-Maximum Values:*		2N1479 2N1481	2N1480 2N1482	2N1700	40347 40347V1 40347V2	40348 40348V1 40348V2	40349 40349V1 40349V2	40367
* COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	60	100	60	60	90	160	100 V
* COLLECTOR-TO-EMITTER VOLTAGE:								
With base open, sustaining	$V_{CEO}(sus)$	40	55	40	40	65	140	55 V
With emitter-to-base reverse biased (V_{EB} = 1.5 volts)	V_{CEV}	60	100	60	60	90	160	100 V
* EMITTER-TO-BASE VOLTAGE	V_{EBO}	12	12	6	7	7	7	12 V
* COLLECTOR CURRENT	I_C	1.5	1.5	1	1.5	1.5	1.5	1.5 A
PEAK COLLECTOR CURRENT	I_{CM}	–	–	–	3.0	3.0	3.0	– A
* EMITTER CURRENT	I_E	–1.75	–1.75	–	–	–	–	– A
* BASE CURRENT	I_B	1	1	0.75	0.5	0.5	0.5	1 A
* TRANSISTOR DISSIPATION:	P_T							
At case temperature of 25°C		5	5	5	11.7 (40347V2) 8.75 (40347)	11.7 (40348V2) 8.75 (40348)	11.7 (40349V2) 8.75 (40349)	5 W
At ambient temperature up to 25°C		–	–	–	1.0 (40347) 4.4 (40347V1)	1.0 (40348) 4.4 (40348V1)	1.0 (40349) 4.4 (40349V1)	1 W
* TEMPERATURE RANGE:								
Operating and Storage	T_C, T_{stg}	←			–65 to 200		→	°C
* LEAD TEMPERATURE (During soldering):								
At distances ≥ 1/32 in (0.8 mm) from seating plane for 10 s max.	T_L	–	–	255	230	230	230	255°C

*2N-Series types in accordance with JEDEC registration data

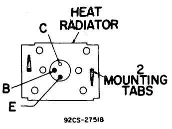
TERMINAL DESIGNATIONS



JEDEC TO-39 or TO-5
2N1479-2N1482,2N1700,
40347-40349,40367



JEDEC TO-39 or TO-5 with Mounting Flange
40347V2, 40348V2,40349V2



JEDEC TO-39 or TO-5 with Heat Radiator
40347V1,40348V1,40349V1

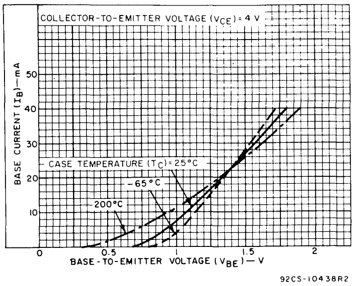


Fig. 1— Typical input characteristics for 2N1479–2N1482.

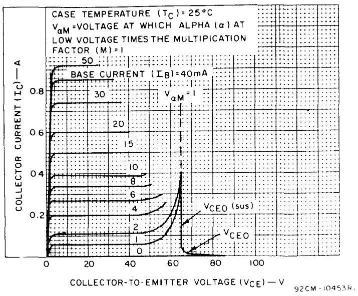


Fig. 2— Typical output characteristics for 2N1479–2N1482.

2N1479-2N1482, 2N1700, 40347-40349, 40367

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS VOLTAGE V dc V_{CE}	TEST CONDITIONS VOLTAGE V dc V_{BE}	TEST CONDITIONS CURRENT A dc I_C	TEST CONDITIONS CURRENT A dc I_B	LIMITS 40347 MIN.	LIMITS 40347 MAX.	LIMITS 40348 MIN.	LIMITS 40348 MAX.	LIMITS 40349 MIN.	LIMITS 40349 MAX.	UNITS
Collector-Cutoff Current With external base-to-emitter resistance (R_{BE}) = 1 kΩ	I_{CER}	30				–	1	–	–	–	–	μA
		60				–	–	–	1	–	–	
		90				–	–	–	–	–	2	
With R_{BE} = 1 kΩ and T_C = 150°C	I_{CER}	30				–	1	–	–	–	–	mA
		60				–	–	–	1	–	–	
		90				–	–	–	–	–	1	
Emitter-Cutoff Current	I_{EBO}		–7			–	10	–	10	–	10	μA
DC Forward-Current Transfer Ratio	h_{FE}	4		0.15		–	–	–	–	30	125	
		4		0.30		–	–	30	125	–	–	
		4		0.45		25	100	–	–	10	–	
		4		1.00		–	–	10	–	–	–	
Collector-to-Emitter Sustaining Voltage: With base-emitter junction reverse biased	$V_{CEV}(sus)$		–1.5	0.050		60	–	90	–	160[a]	–	V
With base open	$V_{CEO}(sus)$			0.050		40	–	65	–	140[a]	–	V
Base-to-Emitter Voltage	V_{BE}	4		0.15		–	–	–	–	–	1.1	V
		4		0.30		–	–	–	1.3	–	–	
		4		0.45		–	1.5	–	–	–	–	
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$			0.15	15 mA	–	–	–	–	–	0.15	V
				0.30	30 mA	–	–	–	0.75	–	–	
				0.45	45 mA	–	1	–	–	–	–	
Forward-Bias Second Breakdown Collector Current (1-s non-repetitive pulse)	$I_{S/b}$	38				345	–	–	–	–	–	mA
		63				–	–	208	–	–	–	
		138				–	–	–	–	95	–	
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$					20(max.) 40347 15(max.) 40347V2		20(max.) 40348 15(max.) 40348V2		20(max.) 40349 15(max) 40349V2		°C/W
Thermal Resistance: Junction-to-Ambient	$R_{\theta JA}$					40(max.) 40347V1		40(max.) 40348V1		40(max) 40349V1		°C/W

[a] Pulsed; pulse duration = 300 μs, duty factor ⩽ 2%.

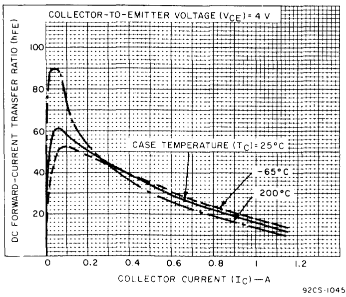


Fig. 3— Typical dc beta characteristics for 2N1479–2N1482.

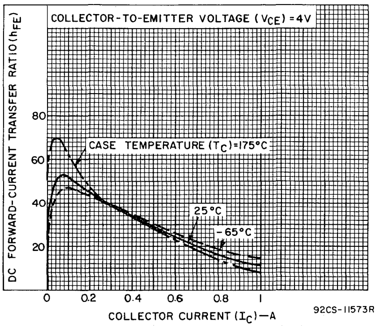


Fig.4—Typical dc beta characteristics for 2N1700.

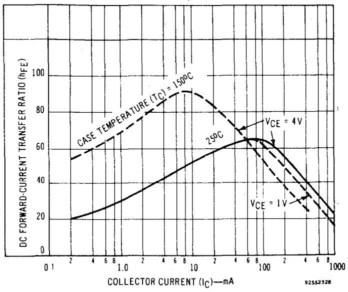


Fig.5—Typical dc beta characteristics for 40347.

2N1479-2N1482, 2N1700, 40347-40349, 40367

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS						LIMITS												UNITS
		VOLTAGE V dc			CURRENT mA dc			2N1479		2N1480		2N1481		2N1482		2N1700		40367		
		V_{CB}	V_{CE}	V_{EB}	I_C	I_B	I_E	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
* Collector Cutoff Current:	I_{CBO}	30					0	–	10	–	10	–	10	–	10	–	75	–	4	μA
T_C = 150°C		30					0	–	500	–	500	–	500	–	500	–	1000	–	–	
* Emitter Cutoff Current	I_{EBO}			12	0			–	10	–	10	–	10	–	10	–	–	–	2	μA
				6	0			–	–	–	–	–	–	–	–	–	25	–	–	
* Collector-To-Emitter Voltage: With base-emitter junction reverse-biased	V_{CEV}			1.5	0.25			60	–	100	–	60	–	100	–	–	–	100	–	V
				1.5	0.5			–	–	–	–	–	–	–	–	60	–	–	–	
With base open, sustaining	V_{CEO}(sus)				50	0		40	–	55	–	40	–	55	–	–	–	55	–	
* Base-To-Emitter Voltage	V_{BE}		4		200			–	3	–	3	–	3	–	3	–	–	–	3	V
			4		100			–	–	–	–	–	–	–	–	–	2	–	–	
Collector-Emitter Saturation Voltage	V_{CE}(sat)				200	10		–	–	–	–	–	–	–	–	–	–	–	1.4	V
* DC Current Transfer Ratio	h_{FE}		4		200			20	60	20	60	35	100	35	100	–	–	35	100	
			4		100			–	–	–	–	–	–	–	–	20	80	–	–	
Small-Signal Current Transfer Ratio	h_{fe}		4		5			50 Typ.*		50 typ.*		50 Typ.*		50 Typ.*		40 Typ.		–	–	
* DC Collector-To-Emitter Saturation Resistance	r_{CE}(sat)				200	20		–	7	–	7	–	–	–	–	–	–	–	–	Ω
					200	10	–	–	–	–	–	–	7	–	7	–	–	–	–	
					100	10	–	–	–	–	–	–	–	–	–	–	10	–	–	
Collector-To-Base Capacitance	C_{ob}	40						150 Typ.*		150 Typ.*		150 Typ.*		150 Typ.*		150 Typ.		–	–	pF
Thermal Time Constant	τ_1							10 Typ.*		10 Typ.*		10 Typ.*		10 Typ.*		10 Typ.		–	–	ms
Alpha-Cutoff Frequency	$f_{\alpha b}$	28			5			1.5 Typ.*		1.5 Typ.*		1.5 Typ.*		1.5 Typ.*		1.5 Typ.		–	–	MHz
Switching Time: Delay Time	t_d●							0.2 Typ.*		0.2 Typ.*		0.2 Typ.*		0.2 Typ.*		0.2 Typ.		–	–	
Rise Time	t_r●							1 Typ.*		1 Typ.*		1 Typ.*		1 Typ.*		1 Typ.		–	–	
Storage Time	t_s●							0.6 Typ.*		0.6 Typ.*		0.6 Typ.*		0.6 Typ.*		0.6 Typ.		–	–	
Fall Time	t_f●							1 Typ.*		1 Typ.*		1 Typ.*		1 Typ.*		1 Typ.		–	–	
* Thermal Resistance: Junction-to-case	$R_{\theta JC}$								35		35		35		35		35	–	35	
Junction-to-free air	$R_{\theta JFA}$								200		200		200		200		200	–	–	

*2N-Series types in accordance with JEDEC registration data.

● I_C = 200 mA, I_{B_1} = 20 mA, I_{B_2} = –85. mA

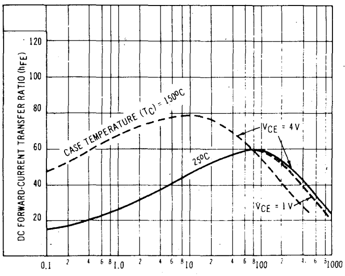


Fig.6—Typical dc beta characteristics for 40348.

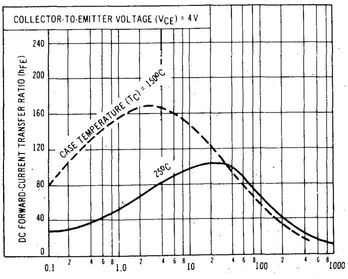


Fig.7—Typical dc beta characteristics for 40349.

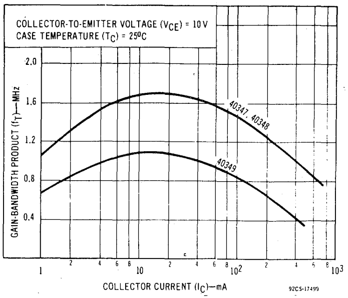


Fig.8—Typical gain-bandwidth product vs. collector current for 40347, 40348 and 40349.

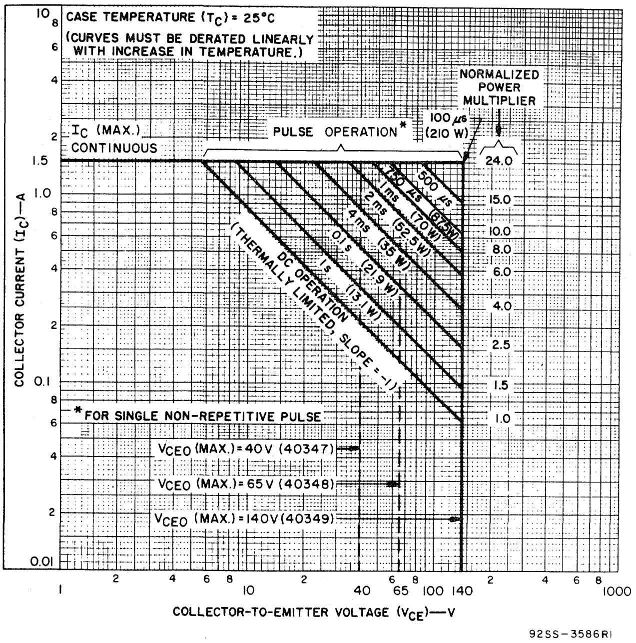


Fig.9—Maximum operating areas for 40347, 40348, and 40349.

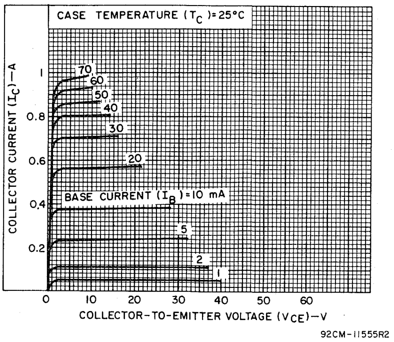


Fig.10—Typical output characteristics for 2N1700.

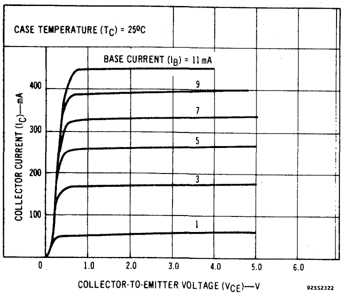


Fig.11—Typical output characteristics for 40347.

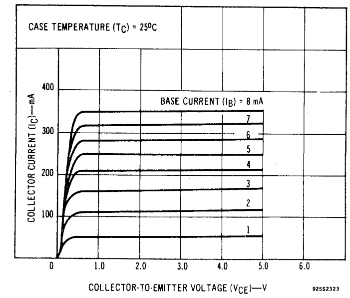


Fig.12—Typical output characteristics for 40348.

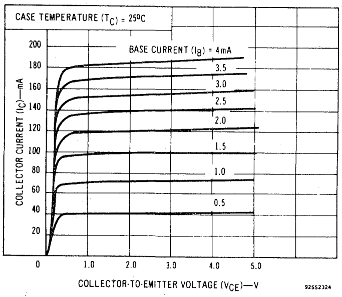


Fig.13—Typical output characteristics for 40349.

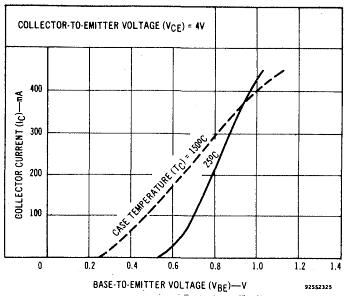


Fig.14—Typical transfer characteristics for 40347.

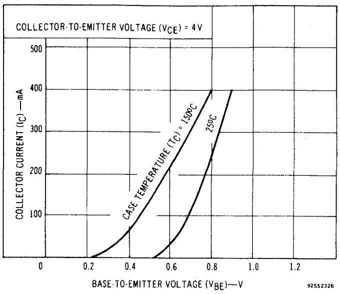


Fig.15—Typical transfer characteristics for 40348.

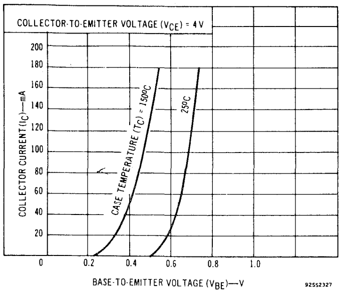


Fig.16—Typical transfer characteristics for 40349.

2N1479-2N1482, 2N1700, 40347-40349, 40367

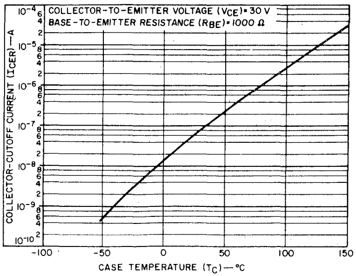


Fig.17—Collector-cutoff-current characteristic for 40347.

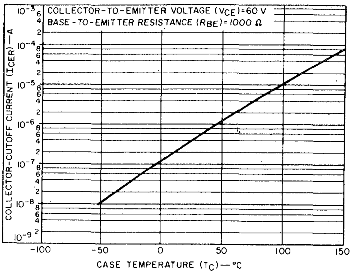


Fig.18—Collector-cutoff-current characteristic for 40348.

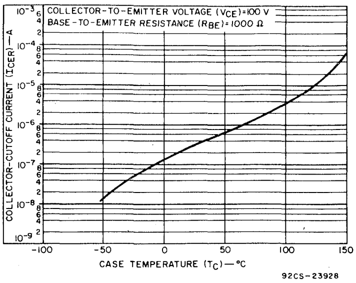


Fig.19—Collector-cutoff-current characteristic for 40349.

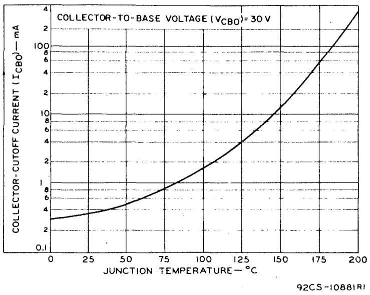


Fig.20—Typical leakage characteristics for 2N1479—2N1482.

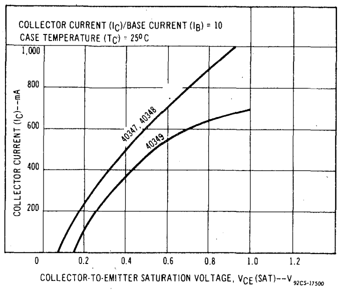


Fig.21—Typical saturation characteristics for 40347, 40348 and 40349.

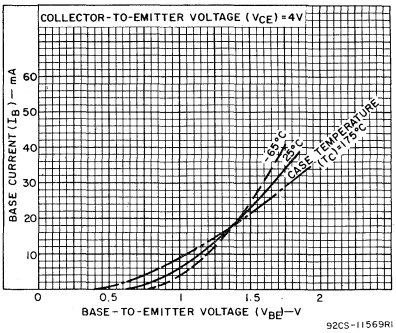


Fig.22—Typical input characteristics for 2N1700.

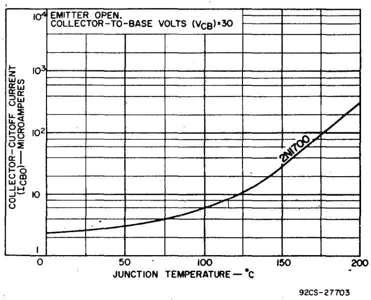


Fig. 23 — Typical leakage characteristics for 2N1700.

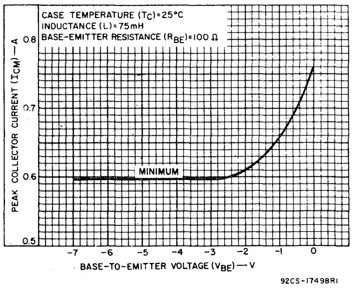


Fig.24—Reverse-bias second-breakdown characteristics for 40347, 40348 and 40349.

2N1483-2N1486, 2N1701, 40368

Hometaxial-Base Silicon N-P-N Power Transistors

General-Purpose Types for Medium-Power Applications

These RCA types are hometaxial-base power transistors of the silicon n-p-n type intended for a wide variety of applications in industrial and military equipment. They are particularly useful in power-switching circuits such as in dc-to-dc converters, inverters, choppers, solenoid and relay control; in oscillator, regulator, and pulse amplifier circuits; and as class-A and class-B push-pull audio and servo amplifiers.

These transistors feature high beta at high current, and excellent high-temperature performance. They are supplied in the JEDEC TO-8 hermetic package.

Maximum Ratings, *Absolute-Maximum Values:*

		2N1483 2N1485	2N1484 2N1486 40368	2N1701	
* COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	60	100	60	V
* COLLECTOR-TO-EMITTER VOLTAGE:					
With base open (sustaining voltage)	$V_{CEO}(sus)$	40	55	40	V
With emitter-to-base reverse biased (V_{EB}) = 1.5 volts)	V_{CEV}	60	100	60	V
* EMITTER-TO-BASE VOLTAGE	V_{EBO}	12	12	6	V
* COLLECTOR CURRENT	I_C	3	3	2.5	A
* EMITTER CURRENT	I_E	−3.5	−3.5	–	A
* BASE CURRENT	I_B	1.5	1.5	1	A
* TRANSISTOR DISSIPATION:	P_T				
At case temperature of 25°C		25	25	25	W
At case temperature of 100°C		14.1	14.1		
* TEMPERATURE RANGE:					
Operating and Storage	T_J, T_{stg}		−65 to +200		°C
PIN TEMPERATURE (During soldering):					
At distance ⩾1/32 in. (0.79 min) from seating plane for 10 s max.	T_L		235		°C

*2N-Series types in accordance with JEDEC registration data

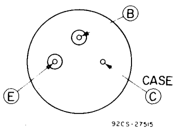
Features:

- High-temperature characterization
- High dc beta at 750 mA
- Full switching-time characterization at 750 mA

Additional Features for 40368:

- High reliability assured by five preconditioning steps
- Group A test data in data bulletin.

TERMINAL DESIGNATIONS



JEDEC-TO-8

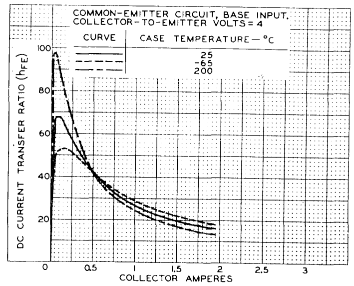


Fig. 1 — Typical dc beta characteristics for 2N1483—2N1486, and 40368.

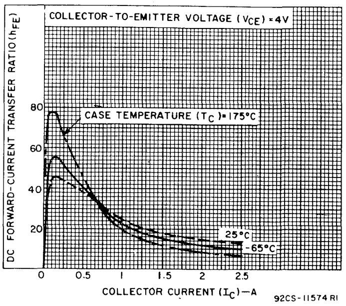


Fig. 2 — Typical dc beta characteristics for 2N1701.

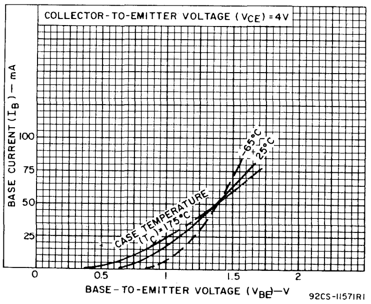


Fig. 3 — Typical input characteristics for 2N1701.

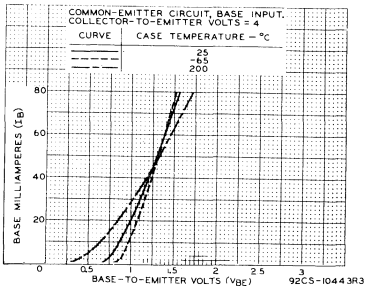


Fig. 4 — Typical input characteristics for 2N1483—2N1486, and 40368.

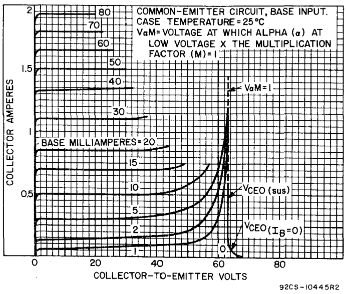


Fig. 5 — Typical output characteristics for 2N1483—2N1486, and 40368.

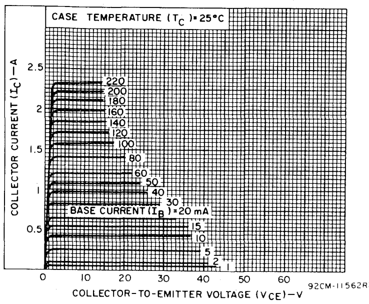


Fig. 6 — Typical output characteristics for 2N1701.

2N1483-2N1486, 2N1701, 40368

ELECTRICAL CHARACTERISTICS, *at Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	TEST CONDITIONS				LIMITS												UNITS
	VOLTAGE V dc		CURRENT mA dc		2N1483		2N1484		2N1485		2N1486		2N1701		40368		
	V_{CB}	V_{CE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
* I_{CBO}	60				–	–	–	–	–	–	–	–	–	50	–	–	µA
	30				–	15	–	15	–	15	–	15	–	100	–	9	
At T_C = 150°C	30				–	750	–	750	–	750	–	750	–	1500	–	–	
* I_{EBO}																	µA
V_{EB} = 12 V			0		–	15	–	15	–	15	–	15	–	–	–	5	
= 6			0		–	–	–	–	–	–	–	–	–	50	–	–	
* h_{FE}		4	750ª		20	60	20	60	35	100	35	100	–	–	35	100	
		4	300ª		–	–	–	–	–	–	–	–	20	80	–	–	
		20	2500ª		–	–	–	–	–	–	–	–	5	–	–	–	
* V_{CEO}(sus)			100ª	0	40	–	55	–	40	–	55	–	40ᵇ	–	55	–	V
* V_{CEV} V_{BE} = –1.5 V			0.25		60	–	100	–	60	–	100	–	–	–	100	–	
* V_{CEX} V_{BE} = –1.5 V			0.75		–	–	–	–	–	–	–	–	60ᵇ	–	–	–	V
* V_{BE}		4	750ª		–	3.5	–	3.5	–	2.5	–	2.5	–	–	–	2.5	V
		4	300ª		–	–	–	–	–	–	–	–	–	3	–	–	
		20	2500ª		–	–	–	–	–	–	–	–	–	13	–	–	
* V_{CE}(sat)			750	40	–	–	–	–	–	–	–	–	–	–	–	0.75	V
			2500ª	1000	–	–	–	–	–	–	–	–	–	12.5	–	–	
* r_{CE}(sat)			750	75	–	2.67	–	2.67	–	1	–	1	–	–	–	–	Ω
			300	30	–	–	–	–	–	–	–	–	–	5	–	–	
* C_{ob}	40				175 (typ.)		175 (typ.)		175 (typ.)		175 (typ.)		175 (typ.)		–	–	pF
* τ_1					10 (typ.)		10 (typ.)		(10 (typ.)		10 (typ.)		10 (typ.)		–	–	ms
* $f_{\alpha b}$	28		5		1.25 (typ.)		1.25 (typ.)		1.25 (typ.)		1.25 (typ.)		–		–	–	MHz
* f_{hfb}	6			5	–	–	–	–	–	–	–	–	350	–	–	–	kHz
	28		0.5	100	–		–		–		–		1 (typ.)		–		MHz
t_d●					0.2 (typ.)		0.2 (typ.)		0.2 (typ.)		0.2 (typ.)		0.2 (typ.)		–	–	µs
t_r●					1 (typ.)		1 (typ.)		1 (typ.)		1 (typ.)		1 (typ.)		–	–	
t_s●					0.8 (typ.)		0.8 (typ.)		0.8 (typ.)		0.8 (typ.)		0.8 (typ.)		–	–	
t_f●					1.1 (typ.)		1.1 (typ.)		1.1 (typ.)		1.1 (typ.)		1.1 (typ.)		–	–	
* $R_{\theta JC}$					–	7	–	7	–	7	–	7	–	7	–	–	°C/W
* $R_{\theta JA}$					–	100	–	100	–	100	–	100	–	100	–	–	

ª Pulsed, pulse duration = 300 µs, duty factor = 1.8%. ● I_C = 750 mA, I_{B_1}, = 20 mA, I_{B_2} = –8.5 mA. * 2N-Series types in accordance with JEDEC registration data.

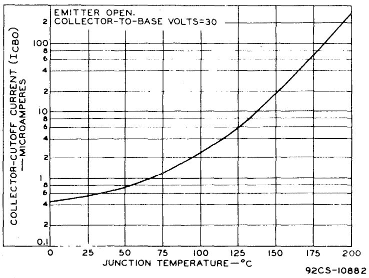


Fig. 7 — Typical collector-cutoff current for 2N1483—2N1486 and 40368.

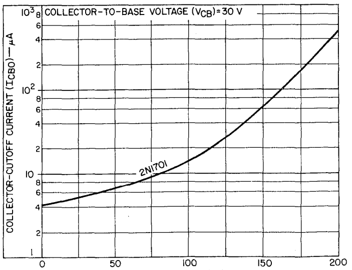


Fig. 8 — Typical collector-cutoff current characteristics for 2N1701.

2N1487-2N1490, 2N1702, 40369

Hometaxial-Base Silicon N-P-N Power Transistors

General-Purpose Types for High-Power Applications

These RCA types are hometaxial-base power transistors of the silicon n-p-n type intended for a wide variety of applications in industrial and military equipment. They are particularly useful in power-switching circuits such as in dc-to-dc converters, inverters, choppers, solenoid and relay controls; in oscillator, regulator, and pulse-amplifier circuits; and as class-A and class-B push-pull audio and servo amplifiers.

These transistors feature high power-dissipation ratings, high beta at high current, and excellent high-temperature performance. They are supplied in the JEDEC TO-3 hermetic package.

Features:

- High-temperature characterization
- High dc beta at 1.5A
- Full switching-time characterization at 1.5A

Additional Features for 40369:

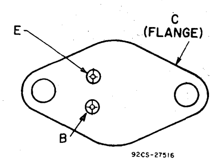
- High reliability assured by five preconditioned steps
- Group A test data included.

Maximum Ratings, *Absolute-Maximum Values:*

		2N1487 2N1489	2N1488 2N1490 40369	2N1702	
* COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	60	100	60	V
* COLLECTOR-TO-EMITTER VOLTAGE:					
With base open (sustaining voltage)	$V_{CEO}(sus)$	40	55	40	V
With emitter-to-base reverse biased (V_{EB}) = 1.5 volts)	V_{CEV}	60	100	60	V
* EMITTER-TO-BASE VOLTAGE	V_{EBO}	10	10	6	V
* COLLECTOR CURRENT	I_C	6	6	5	A
* EMITTER CURRENT	I_E	–8	–8	–	A
* BASE CURRENT	I_B	3	3	2.5	A
* TRANSISTOR DISSIPATION:	P_T				
At mounting-flange temperature of 25°C		75	75	75	W
At mounting-flange temperature of 100°C		43	43		W
* TEMPERATURE RANGE:					
Operating and Storage	T_C, T_{stg}		-65 to 200		°C
PIN TEMPERATURE (During soldering): At distance ≥ 1/32 in. (0.79 mm) from seating plane for 10 s max.	T_L		235		°C

*2N-Series types in accordance with JEDEC registration data

TERMINAL DESIGNATIONS



JEDEC TO-3

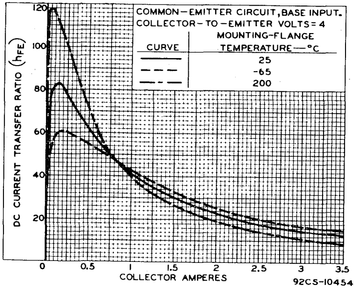


Fig. 1 — Typical dc beta characteristics for 2N1487–2N1490, and 40369.

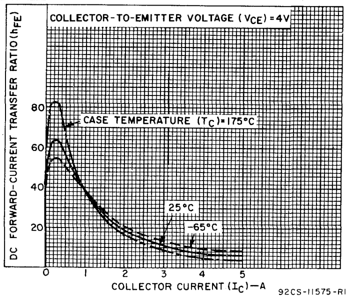


Fig. 2 — Typical dc beta characteristics for 2N1702.

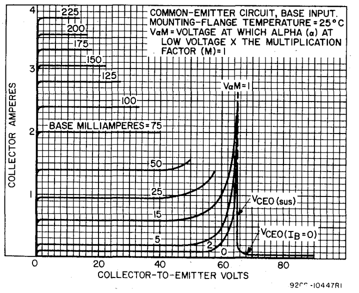


Fig. 3 — Typical output characteristics for 2N1487–2N1490, and 40369.

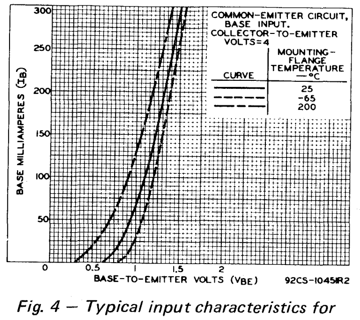


Fig. 4 — Typical input characteristics for 2N1487–2N1490, and 40369.

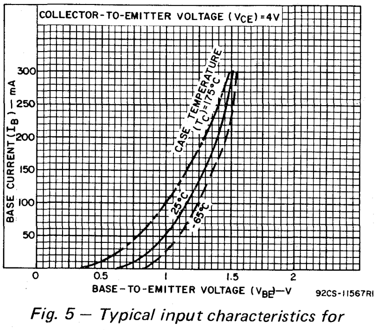


Fig. 5 — Typical input characteristics for 2N1702.

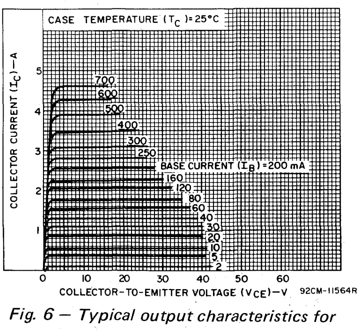


Fig. 6 — Typical output characteristics for 2N1702.

2N1487-2N1490, 2N1702, 40369

ELECTRICAL CHARACTERISTICS *Mounting-flange temperature = 25°C unless otherwise specified*

CHARACTERISTIC	TEST CONDITIONS					LIMITS												UNITS
	DC COLLECTOR VOLTAGE (VOLTS)		DC EMITTER VOLTAGE (VOLTS)	DC COLLECTOR CURRENT (mA)	DC BASE CURRENT (mA)	TYPE 2N1487		TYPE 2N1488		TYPE 2N1489		TYPE 2N1490		TYPE 2N1702		TYPE 40369		
	V_{CB}	V_{CE}	V_{EB}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
* I_{CBO}	30					–	25	–	25	–	25	–	200	–	200	–	10	µA
	60					–	–	–	–	–	–	–	–	–	100	–	–	
At $T_C = 150°C$	30					–	1000	–	1000	–	1000	–	1000	–	2000	–	–	µA
* I_{EBO}				0		–	–	–	–	–	–	–	–	–	100	–	–	µA
I_{EBS}			10	0		–	25	–	25	–	25	–	25	–	–	–	6	µA
* V_{CEX}			1.5	0.25		–	–	–	–	–	–	–	–	–	–	100	–	V
			1.5	0.5		60	–	100	–	60	–	100	–	–	–	–	–	
			1.5	1		–	–	–	–	–	–	–	–	60[b]	–	–	–	
* $V_{CEO}(sus)$				100	0	40	–	55	–	40	–	55	–	40[b]	–	55	–	V
* h_{FE}		4		1500		15	45	15	45	25	75	25	75	–	–	25	75	
		4		800		–	–	–	–	–	–	–	–	15	60	–	–	
		20		5000		–	–	–	–	–	–	–	–	3.5	–	–	–	
* $r_{CE}(sat)$				1500	300	–	2	–	2	–	–	–	–	–	–	–	–	Ω
				1500	100	–	–	–	–	–	0.67	–	0.67	–	–	–	–	
				800	80	–	–	–	–	–	–	–	–	–	4	–	–	
* V_{BE}		4		1500		–	3.5	–	3.5	–	2.5	–	2.5	–	–	–	2.5	V
		4		250		–	–	–	–	–	–	–	–	–	4	–	–	
		20		300		–	–	–	–	–	–	–	–	–	20.5	–	–	
* $V_{CE}(sat)$				5000	2000	–	–	–	–	–	–	–	–	–	20	–	–	V
* C_{ob}	40					–	200	–	200	–	200	–	200	200 (typ.)		–	–	pF
* τ_l						12 (typ.)		12 (typ.)		12 (typ.)		12 (typ.)		12 (typ.)		–	–	ms
* $f_{\alpha b}$	12			100		1 (typ.)		1 (typ.)		1 (typ.)		1 (typ.)		–	–	–	–	MHz
* f_{hfb}	6				100	–	–	–	–	–	–	–	–	300	–	–	–	kHz
	28			0.5		–	–	–	–	–	–	–	–	1 (typ.)		–	–	MHz
t_d■						0.2 (typ.)		0.2 (typ.)		0.2 (typ.)		0.2 (typ.)		0.2 (typ.)		–	–	µs
t_r■						1 (typ.)		1 (typ.)		1 (typ.)		1 (typ.)		1 (typ.)		–	–	
t_s■						1 (typ.)		1 (typ.)		1 (typ.)		1 (typ.)		1 (typ.)		–	–	
t_f■						1.2 (typ.)		1.2 (typ.)		1.2 (typ.)		1.2 (typ.)		1.2 (typ.)		–	–	
* $R_{\theta JC}$						–	2.33	–	2.33	–	2.33	–	2.33	–	2.33	–	–	°C/W

* 2N-Series types in accordance with JEDEC registration data.

■ $I_C = 1.5$ A, $I_{B'} = 300$ mA, $I_{B_2} = -150$ mA

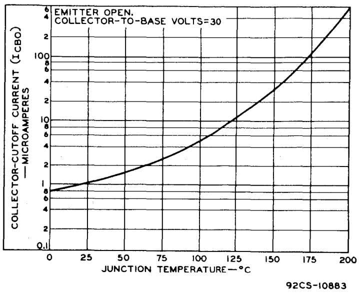


Fig. 7 – Typical collector-cutoff current characteristic for 2N1487–2N1490, and 40369.

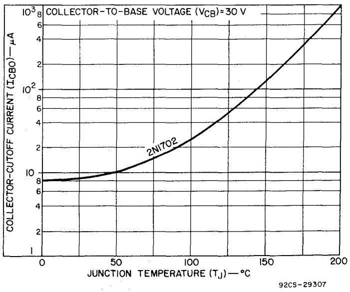


Fig. 8 – Typical collector-cutoff current characteristics for 2N1702.

2N3054, 2N6260, 2N6261, 40250, 40372, 40910, 40911

Hometaxial-Base Medium-Power Silicon N-P-N Transistors

Rugged Devices for Intermediate-Power Applications in Industrial and Commercial Equipment

These RCA types are hometaxial-base silicon n-p-n transistors intended for a wide variety of medium- to high-power applications. Types 2N3054, 2N6260, 2N6261, and 40250 are supplied in the JEDEC TO-66 hermetic package.

Types 40250V1, 40372, 40910, and 40911 are the 40250, 2N3054, 2N6260, and 2N6061 with factory-attached heat radiators intended for printed-circuit-board applications.

Maximum Ratings, *Absolute-Maximum Values:*

		40250 40250V1	2N6260 40910	2N3054 40372	2N6261 40911	
* COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	50	50	90	90	V
COLLECTOR-TO-EMITTER VOLTAGE:						
* With base open	V_{CEO}	40	40	55	80	V
* With external base-to-emitter resistance (R_{BE}) = 100Ω	$V_{CER}(sus)$	–	45	60	85	V
With base reverse-biased (V_{BE} = -1.5 V)	$V_{CEV}(sus)$	50	50	90	90	V
* EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	5	7	7	V
* CONTINUOUS COLLECTOR CURRENT	I_C	4	3	4	4	A
* CONTINUOUS BASE CURRENT	I_B	2	2	2	2	A
* TRANSISTOR DISSIPATION:	P_T					
* At case temperature up to 25°C		29 (40250)	29 (2N6260)	25 (2N3054)	50 (2N6261)	W
At ambient temperatures up to 25°C		5.8 (40250V1)	5.8 (40910)	5.8 (40372)	5.8 (40911)	W
* At temperatures above 25°C		Derate linearly to 200 °C				
* TEMPERATURE RANGE:						
Storage & Operating (Junction)		-65 to 200				°C
PIN TEMPERATURE (During soldering):						
At distance ⩾1/32 in. (0.8 mm) from seating plane for 10 s max.		235				°C

*In accordance with JEDEC registration data format JS-9 RDF-10 (2N3054), JS-6 RDF-2 (2N6260, 2N6261)

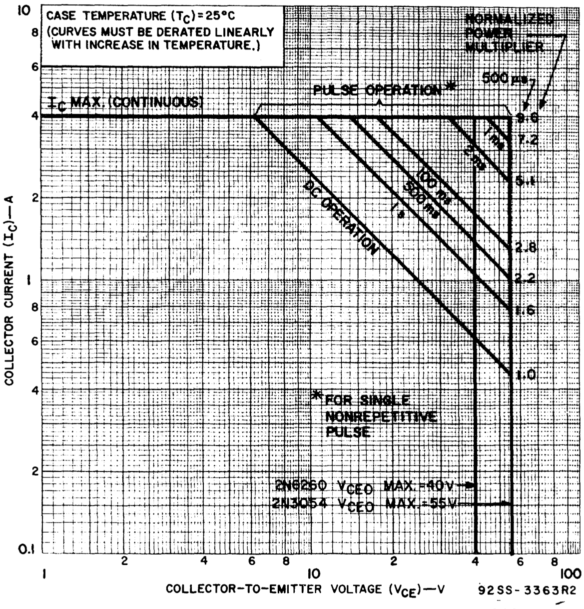


Fig. 1—Maximum operating areas for 2N3054 and 2N6260.

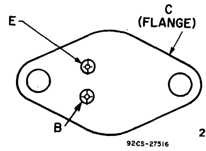
Features:

- f_T = 800 kHz at 0.2A (2N3064, 40372)
- Maximum safe-area-of-operation curves for dc and pulse operation
- $V_{CEV}(sus)$ = 90 V min (2N3054, 2N6261)
- Low saturation voltage: $V_{CE}(sat)$ = 1.0 V at I_C = 0.5 A (2N3054)

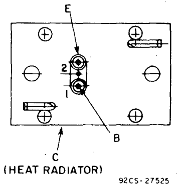
Applications:

- Power switching circuits
- Series- and shunt-regulator driver and output stages
- High-fidelity amplifiers
- Solenoid drivers.

TERMINAL DESIGNATIONS



JEDEC TO-66
2N3054, 2N6260, 2N6261, 40250



JEDEC TO-66 with Heat Radiator
40250V1, 40372, 40910, 40911

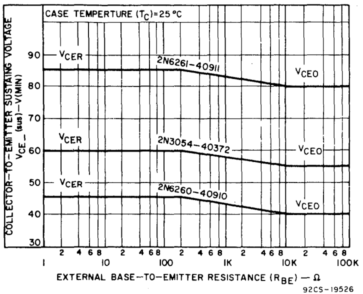


Fig. 2 — Sustaining voltage vs. base-to-emitter resistance for 2N3054, 2N6260, 2N6261, 40372, 40910 and 40911.

2N3054, 2N6260, 2N6261, 40250, 40372, 40910, 40911

ELECTRICAL CHARABTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS								UNITS
		VOLTAGE V dc		CURRENT A dc		2N6260 40910		2N3054 40372		2N6261 40911		40250 40250V1		
		V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
* Collector-Cutoff Current: With base open	I_{CBO}	V_{CB} = 30		I_E = 0		–	–	–	–	–	–	–	1	mA
	I_{CEO}	30			0	–	1	–	0.5	–	–	–	–	
		60			0	–	–	–	–	–	0.5	–	–	
With base-emitter junction reverse-biased	I_{CEV}	40	–1.5			–	5	–	–	–	–	–	–	
		80	–1.5			–	–	–	–	–	0.5	–	–	
		90	–1.5			–	–	–	1.0	–	–	–	–	
	I_{CBO}	VCB = 30		I_E = 0		–	–	–	–	–	–	–	5	
At T_C = 150°C	I_{CEV}	40	–1.5			–	25	–	–	–	–	–	–	
		80	–1.5			–	–	–	–	–	1.0	–	–	
		90	–1.5			–	–	–	6.0	–	–	–	–	
* Emitter-Cutoff Current	I_{EBO}		–5		0	–	5	–	–	–	–	–	5	mA
			–7		0	–	–	–	1.0	–	0.2	–	–	
Collector-to-Base Breakdown Votlage	$V_{(BR)CBO}$			0.05		–	–	–	–	–	–	50	–	V
Collector-to-Emitter Breakdown Voltage	$V_{(BR)CEV}$		–1.5	0.05		–	–	–	–	–	–	50	–	V
Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$			0.1^a	0	40	–	55	–	80	–	40	–	V
With external base-to-emitter resistance (R_{BE}) = 100Ω	$V_{CER}(sus)$			0.1^a		45	–	60	–	85	–	–	–	
Emitter-to-Base Breakdown Voltage I_E = 0.005 mA	$V_{(BR)EBO}$					–	–	–	–	–	–	5	–	V
* DC Forward-Current Transfer Ratio	h_{FE}	2		4^a		3	–	–	–	5	–	–	–	
		2		1.5^a		–	–	–	–	25	100	–	–	
		4		3^a		–	–	5	–	–	–	–	–	
		4		0.5^a		–	–	25	150	–	–	–	–	
		4		1.5^a		20	100	–	–	–	–	25	100	
* Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$			0.5^a	0.05^a	–	–	–	1.0	–	–	–	–	V
				1.5^a	0.15^a	–	1.5	–	–	–	0.5	–	1.5	
				3^a	1^a	–	–	–	6.0	–	–	–	–	
* Base-to-Emitter Voltage	V_{BE}	2		1.5		–	–	–	–	–	1.5	–	–	V
		4		1.5		–	2.2	–	–	–	–	–	2.2	
		4		0.5		–	–	–	1.7	–	–	–	–	
* Common-Emitter Small-Signal Short-Circuit, Forward Current Transfer Ratio Cutoff Frequency	f_{hfe}	4		0.1		0.03	–	0.03	–	0.03	–	–	–	MHz
* Magnitude of Common-Emitter, Small-Signal, Short-Circuit Forward Current Transfer Ratio (f = 0.4 MHz)	$\lvert h_{fe} \rvert$	4		0.1		2	–	–	–	2	–	–	–	
* Common-Emitter, Small-Signal, Short-Circuit Forward Current Transfer Ratio (f = 1 kHz)	h_{fe}	4		0.1		25		25	–	25	–	–	–	
Forward-Bias Second Breakdown Collector Current (t - 1 s)	$I_{S/b}$	40				0.725	–	–	–	–	–	–	–	A
		80				–	–	–	–	0.625	–	–	–	
		55				–	–	0.455	–	–	–	–	–	
Thermal Resistance: Junction-to-Case	$R\theta_{JC}$					6 (max.) 2N6260		7 (max.) 2N3054		3.5 (max.) 2N6261		6 (max.) 40250		°C/W
Junction-to-Ambient	$R\theta_{JA}$					30 (max.) 40901		30 (max.) 40372		30 (max.) 40911		30 (max.) 40250V1		

[a]Pulsed: Pulse duration = 300 μs duty factor = 1.8%.

*In accordance with JEDEC registration data format JS-9 RDF-10 (2N3054) JS-6 RDF-2 (2N6260-61)

2N3054, 2N6260, 2N6261, 40250, 40372, 40910, 40911

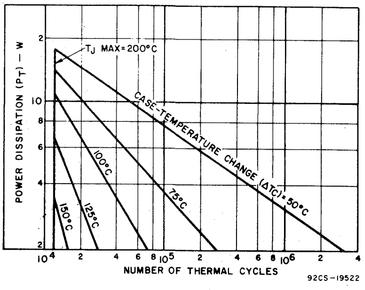


Fig. 3 - Thermal-cycling rating chart for 2N3054.

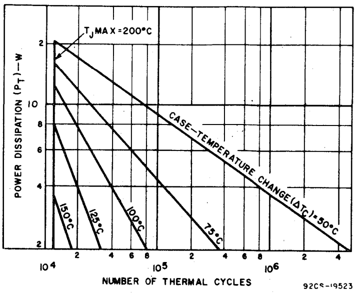


Fig. 4 - Thermal-cycling rating chart for 2N6260.

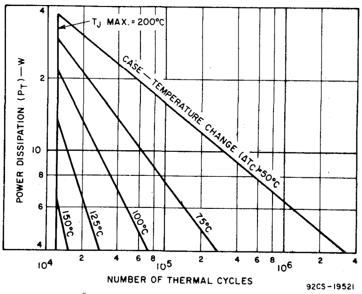


Fig. 5 - Thermal-cycling rating chart for 2N626I.

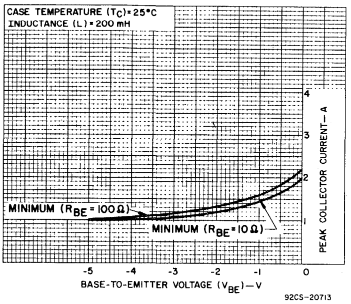


Fig. 7 - Reverse-bias second-breakdown characteristics for all types.

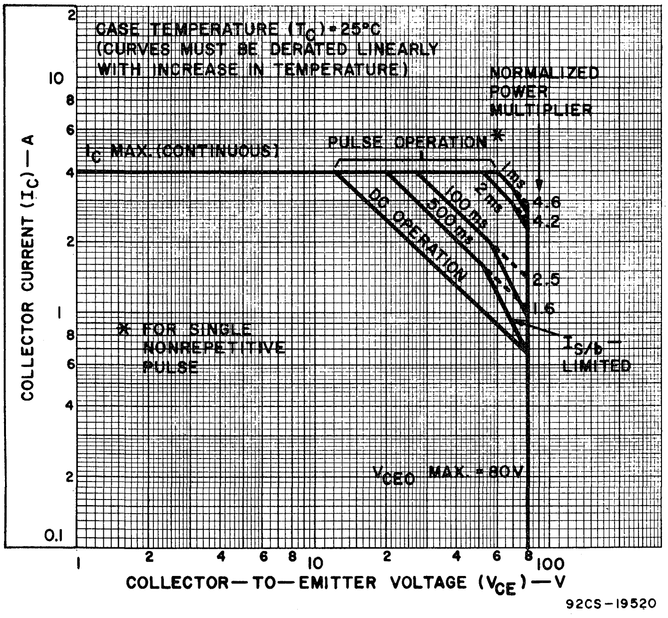


Fig. 6 - Maximum operating areas for 2N6261.

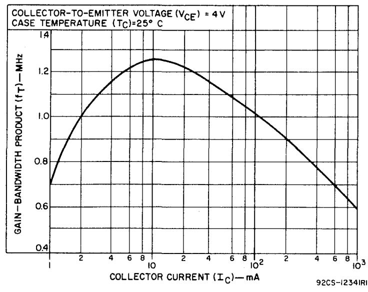


Fig. 8 - Typical gain-bandwidth product for all types.

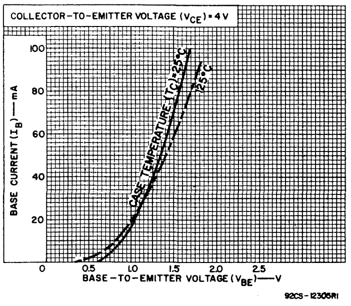


Fig. 9 - Typical input characteristics for 2N3054, 2N6260, 40250, 40250VI, 40372, and 40910.

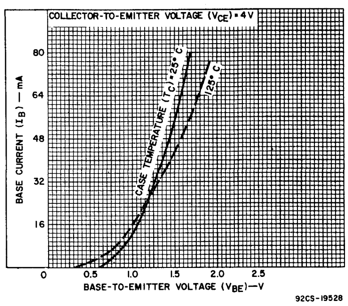


Fig. 10 - Typical input characteristics for 2N626I and 409II.

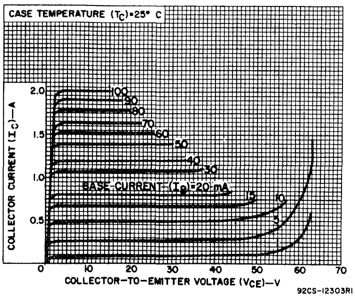


Fig. 11 — Typical output characteristics for 2N3054 and 40372.

2N3054, 2N6260, 2N6261, 40250, 40372, 40910, 40911

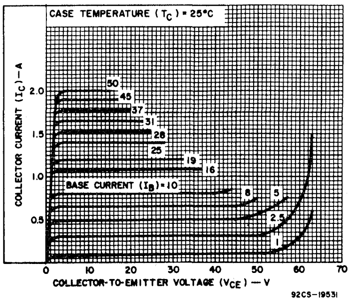


Fig. 12 — Typical output characteristics for 2N6260 and 40910.

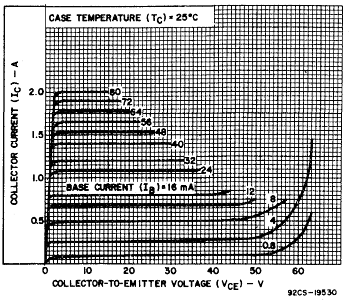


Fig. 13 — Typical output characteristics for 2N6261 and 40911.

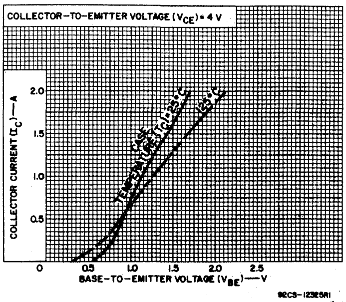


Fig. 14 — Typical transfer characteristics for 2N3054, 2N6260, 40250, 40250V1, 40372 and 40910.

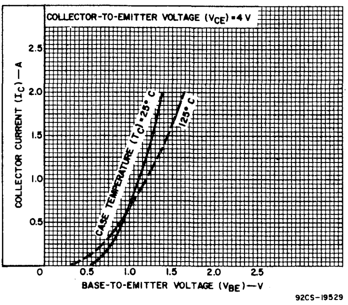


Fig. 15 - Typical transfer characteristics for 2N6261 and 40911.

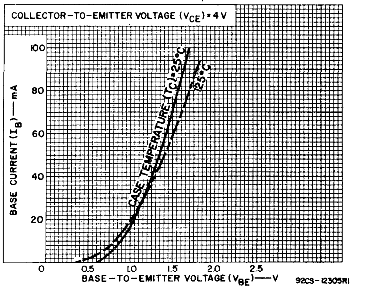


Fig. 16 — Typical input characteristics for 2N6260, 40250, 40250V1, 40372 and 40910.

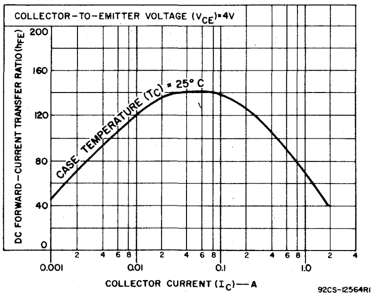


Fig. 17 — Typical dc beta characteristics for 2N6260 40250, 40250V1 and 40910.

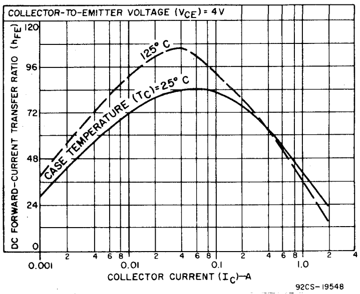


Fig. 18 - Typical dc beta characteristics for 2N6261 and 40911.

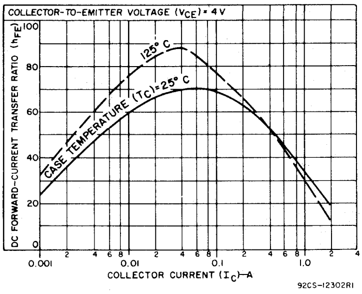


Fig. 19 — Typical dc beta characteristics for 2N3054 and 40372.

2N3055, 2N6569, RCS617, 2N6594, MJ2955, RCS618

Silicon N-P-N and P-N-P Epitaxial-Base High-Power Transistors

Rugged, Broadly Applicable Devices For Industrial and Commercial Use

RCA-2N6594, MJ2955, and RCS618 are epitaxial-base silicon p-n-p transistors featuring high gain at high current. RCA-2N6569, 2N3055, and RCS617 are epitaxial-base silicon n-p-n transistors. They may be used as complements to the 2N6594, MJ2955, and RCS618, respectively. These devices have a dissipation capability of 100 watts (2N6569, 2N6594), 115 watts (2N3055, RCS617, RCS618), and 150 watts (MJ2955) at case temperatures up to 25°C.

They differ in voltage ratings and in the currents at which the parameters are controlled. All are supplied in the steel JEDEC TO-3 hermetic package.

Features:

- High dissipation capability
- Low saturation voltages
- Maximum safe-area-of-operation curves
- Hermetically sealed JEDEC TO-3 package
- High gain at high current
- Thermal-cycling rating curve

Applications:

- Series and shunt regulators
- High-fidelity amplifiers
- Power-switching circuits
- Solenoid drivers

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	N-P-N	2N6569	2N3055	RCS617	
	P-N-P	2N6594◆	MJ2955◆	RCS618◆	
* V_{CBO}		45	100	100	V
$V_{CER}(sus)$					
$R_{BE} = 100\ \Omega$		45	70*	85	V
* $V_{CEO}(sus)$		40	60	80	V
* V_{EBO}		5	7	7	V
* I_C		12	15	15	A
I_{CM}		24	–	–	A
* I_B		5	7	7	A
* I_E		17	–	–	A
* P_T					
At $T_C \leqslant 25°C$		100	115 (2N3055) 150 (MJ2955)	115	W
At $T_C > 25°C$	Derate linearly	0.572	0.66 (2N3055) 0.86 (MJ2955)	0.66	W/°C
* T_{stg}, T_J		–65 to 200			°C
* T_L					
At distance ⩾ 1/32 in. (0.8 mm) from seating plane for 10 s max.		235			°C

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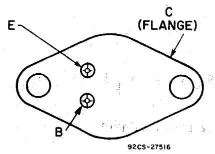
* 2N-types in accordance with JEDEC registration data.

◆ For p-n-p devices, voltage and current values are negative.

TERMINAL DESIGNATIONS



JEDEC TO-3

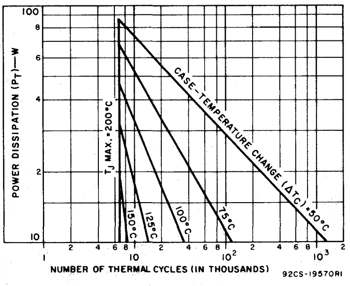


Fig. 1 — Thermal-cycling rating chart.

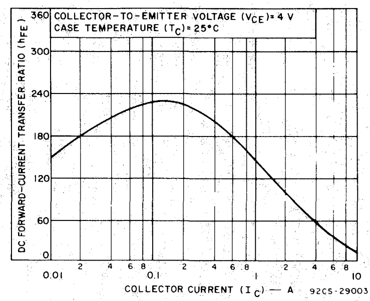


Fig. 5 — Typical dc beta characteristics.◆

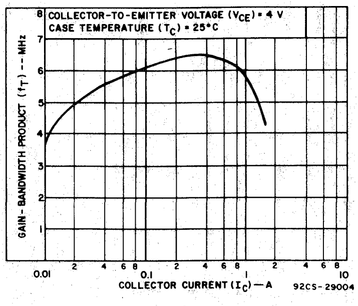


Fig. 3 — Typical gain-bandwidth product.◆

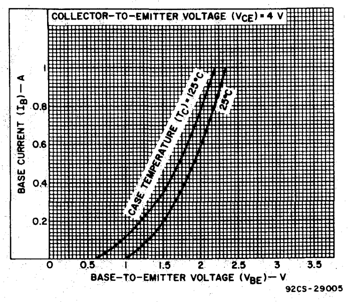


Fig. 4 — Typical input characteristics.◆

◆ For p-n-p devices, voltage and current values are negative.

2N3055, 2N6569, RCS617, 2N6594, MJ2955, RCS618

ELECTRICAL CHARACTERISTICS, *at Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS				LIMITS						UNITS
	VOLTAGE V dc		CURRENT A dc		2N6569 2N6594◆		2N3055 MJ2955◆		RCS617 RCS618◆		
	V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
* I_{CEX}	45	–1.5			–	1	–	–	–	–	mA
2N3055	100	–1.5			–	–	–	5	–	–	
MJ2955	100	–1.5			–	–	–	1	–	–	
RCS617, RCS618	100	–1.5			–	–	–	–	–	1	
* I_{CEX}, T_C = 100°C	45	–1.5			–	10	–	–	–	–	mA
* I_{CEX}, MJ2955	100	–1.5			–	–	–	5	–	5	mA
T_C = 150°C 2N3055	100	–1.5			–	–	–	30	–	–	
I_{CEO}	30			0	–	0.7	–	0.7*	–	0.7	mA
* I_{EBO}		5	0		–	5	–	–	–	–	mA
2N3055		7	0		–	–	–	5	–	–	
MJ2955		7	0		–	–	–	1	–	–	
RCS617, RCS618		7	0		–	–	–	–	–	1	
* V_{CEO}(sus)			0.2	0	40[b]	–	60[b]	–	80[b]	–	V
V_{CER}(sus) R_{BE} = 100			0.2	0	45[b]	–	70[b]*	–	85[b]	–	V
* h_{FE}	3		4[a]		15	200	–	–	–	–	
	4		4[a]		–	–	20	70	–	–	
	4		5[a]		–	–	–	–	20	70	
	4		10[a]		–	–	5	–	–	–	
	4		12[a]		5	100	–	–	–	–	
V_{BE}	4		4[a]		–	1.8*	–	1.8*	–	–	V
	4		5[a]		–	–	–	–	–	1.8	
* V_{BE}(sat)			4	0.55	–	2	–	–	–	–	V
			4	0.4	–	2	–	–	–	–	
* V_{CE}(sat)			4[a]	0.4	–	1.5	–	1.1	–	–	V
			4[a]	0.55	–	1.5	–	–	–	–	
			5[a]	0.5	–	–	–	–	–	1.1	
2N3055			10[a]	3.3	–	–	–	8	–	–	
MJ2955			10[a]	3.3	–	–	–	3	–	–	
			12[a]	2.4	–	4	–	–	–	–	
* f_T 2N6569	4		1		1.5	–	–	–	–	–	MHz
f = 0.5 MHz 2N6594	4		1		2.5	–	–	–	–	–	
* f_{hfe} 2N3055	4		1		–	–	20	–	–	–	kHz
f = 10 kHz MJ2955	4		1		–	–	10	–	–	–	
$\|h_{fe}\|$ f = 1 MHz	4		1		–	–	2.5	–	2.5	–	
MJ2955 (only)	4		0.5		–	–	4	–	–	–	
h_{fe} f = 1 kHz	4		1		15	–	15*	120*	15	–	
$I_{S/b}$ t_p = 1 s nonrep.	40				2.5	–	2.87	–	2.87	–	A
* C_{obo} V_{CB} = 10 V, f = 1 MHz					75	750	–	–	–	–	pF
* t_d V_{CC} = 30 V			2	0.2	–	0.4	–	–	–	–	μs
* t_r I_{B1} = I_{B2}			2	0.2	–	1.5	–	–	–	–	
* t_s			2	0.2	–	5	–	–	–	–	
* t_f			2	0.2	–	1.5	–	–	–	–	
$R_{\theta JC}$ 2N3055					–	1.75*	–	1.5	–	–	°C/W
MJ2955					–		–	1.17	–	–	

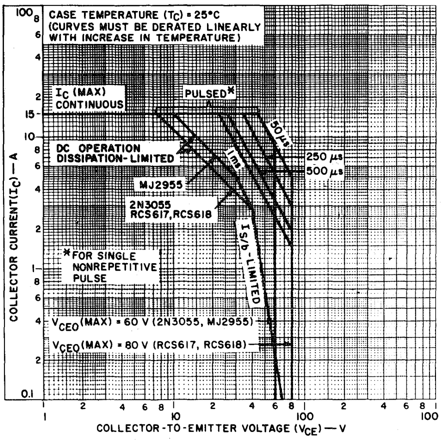
◆ For p-n-p devices, voltage and current values are negative.

* 2N types in accordance with JEDEC registration data.

[a] Pulsed; pulse duration = 300 μs, duty factor = 1.8%.

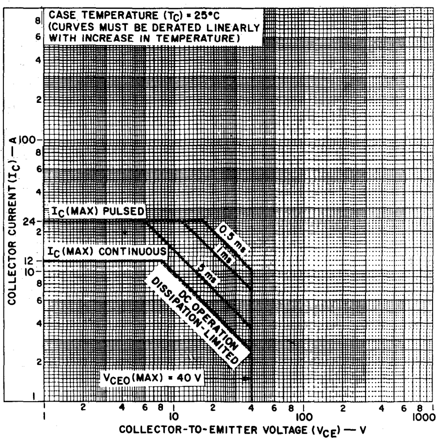
[b] **CAUTION:** Sustaining voltages V_{CEO}(sus) and V_{CER}(sus) *MUST NOT* be measured on a curve tracer.

2N3055, 2N6569, RCS617, 2N6594, MJ2955, RCS618



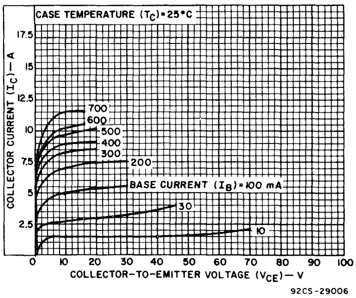
92CS-29001

Fig. 5 — Maximum operating areas for 2N3055, MJ2955, RCS617, and RCS618.◆



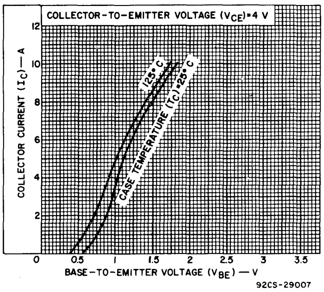
92CS-29002

Fig. 6 — Maximum operating areas for 2N6569 and 2N6594.◆



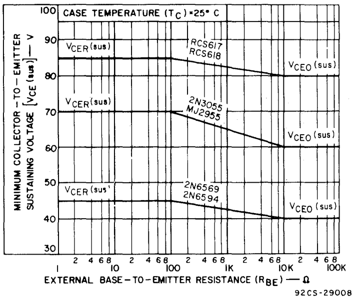
92CS-29006

Fig. 7 — Typical output characteristics.◆



92CS-29007

Fig. 8 — Typical transfer characteristics.◆



92CS-29008

Fig. 9 — Sustaining voltage vs. base-to-emitter resistance.◆

◆ For p-n-p devices, voltage and current values are negative.

2N3055H, 2N6253, 2N6254, 2N6371, 40251

Hometaxial-Base High-Power Silicon N-P-N Transistors

Rugged, Broadly Applicable Devices For Industrial and Commercial Use

These RCA types are silicon n-p-n transistors intended for a wide variety of high-power linear and switching applications. The hometaxial-base construction of these devices makes them highly resistant to second breakdown; for example, the 2N3055H can withstand an $I_{S/b}$ current of 1.95 amperes (min.) at a V_{CEO} of up to 60 volts. For the 2N6254, the $I_{S/b}$ rating is 1.87 amperes (min.) at V_{CEO} up to 80 volts.

All of these transistors are supplied in the JEDEC TO-3 hermetic steel package.

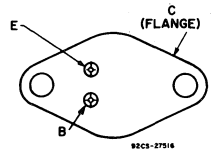
Features:

- 2N6254: premium type from 2N3055H family
- Maximum safe-area-of-operation curves
- Low saturation voltages
- High dissipation ratings
- Thermal-cycle rating curves

Applications:

- Series and shunt regulators
- High-fidelity amplifiers
- Power-switching circuits
- Solenoid drivers
- Low-frequency inverters

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	2N3055H	2N6253	2N6254	2N6371	40251	
*V_{CBO}	100	55	100	50	50	V
*V_{CER}(sus)						
R_{BE} = 100 Ω	70	55	85	45	–	V
*V_{CEO}(sus)	60	45	80	40	40	V
V_{CEV}(sus)						
V_{BE} = −1.5 V	90	55	90	50	50	V
*V_{EBO}	7	5	7	5	5	V
*I_C	15	15	15	15	15	A
*I_B	7	7	7	7	7	A
*P_T:						
≤25°C	115	115	150	117	117	W
>25°C	Derate linearly to 200°C					
*T_J, T_{stg}	−65 to +200					°C
*T_L: During soldering, at distances 1/32 in. (0.8 mm) from seating plane for 10 s max.	235					°C

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*In accordance with JEDEC registration data formats JS-9 RDF-10: 2N3055H; JS-6 RDF-2; 2N6253, 2N6254, 2N6371.

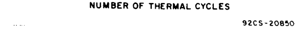


Fig. 1 - Thermal-cycling rating chart for 2N3055H, 2N6253, 2N6371.

Fig. 2 - Thermal cycling rating chart for 2N6254.

Fig. 3 - Typical gain-bandwidth product for all types.

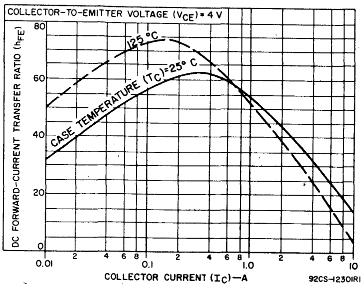


Fig. 4 - Typical dc beta characteristics for 2N3055H and 2N6371.

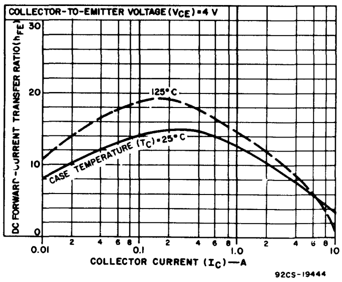


Fig. 5 - Typical dc beta characteristics for 2N6253.

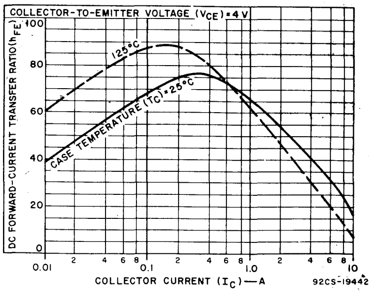


Fig. 6 - Typical dc beta characteristics for 2N6254.

2N3055H, 2N6253, 2N6254, 2N6371, 40251

ELECTRICAL CHARACTERISTICS, *T_C = 25°C Unless Otherwise Specified.*

CHARACTERISTIC	TEST CONDITIONS				LIMITS										UNITS
	VOLTAGE V dc		CURRENT A dc		2N3055H		2N6253		2N6254		2N6371		40251		
	V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
* I_{CEO}	25			0	–	–	–	1.5	–	–	–	1.5	–	–	
	30			0	–	0.7	–	–	–	–	–	–	–	–	mA
	60			0	–	–	–	–	–	1	–	–	–	–	
* I_{CEX}	40	–1.5			–	–	–	–	–	–	–	–	–	2	
	45	–1.5			–	–	–	–	–	–	–	2	–	–	
	55	–1.5			–	–	–	2	–	–	–	–	–	–	
	100	–1.5			–	5	–	–	–	0.5	–	–	–	–	mA
* T_C = 150°C	40	–1.5			–	–	–	–	–	–	–	10	–	10	
	50	–1.5			–	–	–	10	–	–	–	–	–	–	
	100	–1.5			–	30	–	–	–	5	–	–	–	–	
* I_{EBO}		–5			–	–	–	10	–	–	–	–	–	–	mA
		–7			–	5	–	–	–	0.5	–	–	–	–	
$V_{(BR)CBO}$			0.1		–	–	–	–	–	–	–	–	50	–	V
$V_{(BR)CEV}$		–1.5	0.1		–	–	–	–	–	–	–	–	50	–	V
$V_{(BR)EBO}$ I_E = 0.01 mA			0		–	–	–	–	–	–	–	–	5	–	V
* $V_{CEO}(sus)$			0.2^a	0	60	–	45	–	80	–	40	–	40	–	
* $V_{CER}(sus)$ R_{BE} = 100 Ω			0.2^a		70	–	55	–	85	–	45	–	–	–	V
$V_{CEV}(sus)$		–1.5	0.1^a		90	–	55	–	90	–	50	–	–	–	
* h_{FE}	4		3^a		–	–	20	70	–	–	–	–	–	–	
	4		4^a		20	70	–	–	–	–	–	–	–	–	
	2		5^a		–	–	–	–	20	70	–	–	–	–	
	4		8^a		–	–	–	–	–	–	15	60	15	60	
	4		10^a		5	–	–	–	–	–	–	–	–	–	
	4		15^a		–	–	3	–	5	–	–	–	–	–	
	4		16^a		–	–	–	–	–	–	4	–	–	–	
* V_{BE}	4		3^a		–	–	–	1.7	–	–	–	–	–	–	
	4		4^a		–	1.8	–	–	–	–	–	–	–	–	
	2		5^a		–	–	–	–	–	1.5	–	–	–	–	V
	4		8^a		–	–	–	–	–	–	–	–	–	2.2	
	4		16^a		–	–	–	–	–	–	–	4	–	–	
* $V_{CE}(sat)$			3^a	0.3^a	–	–	–	1	–	–	–	–	–	–	
			4^a	0.4^a	–	1.1	–	–	–	–	–	–	–	–	
			5^a	0.5^a	–	–	–	–	–	0.5	–	–	–	–	
			8^a	0.8^a	–	–	–	–	–	–	–	1.5	–	1.5	V
			10^a	3.3^a	–	8	–	–	–	–	–	–	–	–	
			15^a	3^a	–	–	–	–	–	4	–	–	–	–	
			15^a	5^a	–	–	–	4	–	–	–	–	–	–	
			16^a	4^a	–	–	–	–	–	–	–	4	–	–	
* h_{fe} f = 1 kHz	4		1		15	120	10	–	10	–	10	–	–	–	
f_T			1		800	–	–	–	–	–	800	–	–	–	kHz
* $\|h_{fe}\|$ f = 0.4 MHz	4		1		–	–	2	–	2	–	2	–	–	–	
* f_{hfe}	4		1		10	–	10	–	10	–	–	–	–	–	kHz
$I_{S/b}$	39				–	–	–	–	–	–	–	–	3	–	
t_p = 1 s	40				2.9	–	–	–	–	–	2.9	–	–	–	
nonrep.	45				–	–	2.55	–	–	–	–	–	–	–	A
	60				1.95	–	–	–	–	–	–	–	–	–	
	80				–	–	–	–	1.87	–	–	–	–	–	
$R_{\theta JC}$					–	1.5	–	1.5	–	1.17	–	1.5	–	1.5	°C/W

* In accordance with JEDEC registration data formats JS-9 RDF-10: 2N3055H; JS-6 RDF-2: 2N6253, 2N6254, 2N6371.

[a] Pulsed: Pulse duration =300 μs, duty factor = 1.8%.

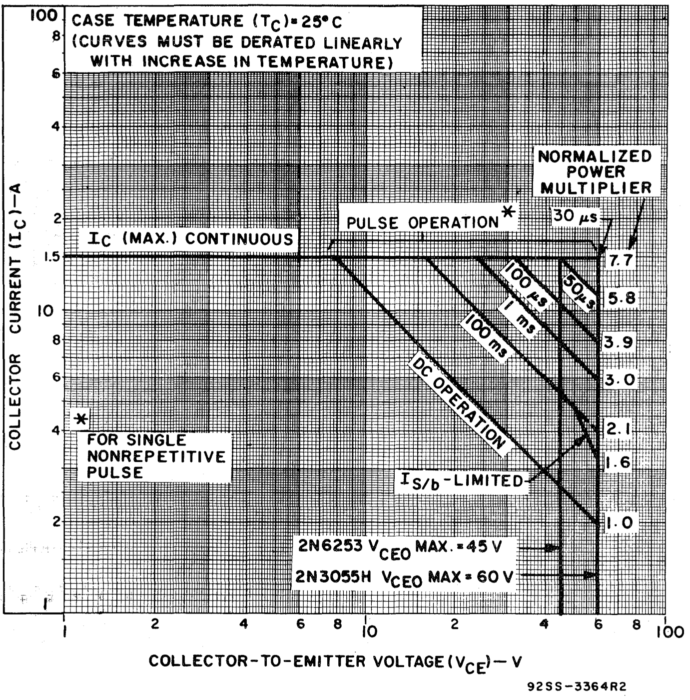


Fig. 7 - Maximum operating areas for types 2N6253 and 2N3055H.

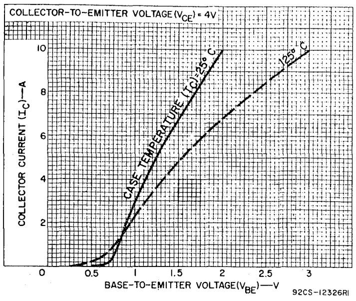


Fig. 8 - Typical transfer characteristics for 2N6254, 2N3055H, 2N6371, 40251.

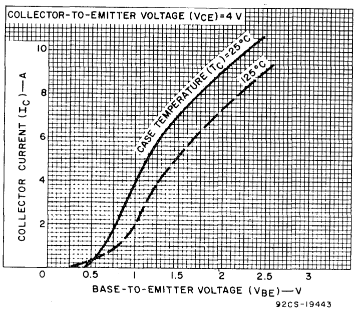


Fig. 9 - Typical transfer characteristics for 2N6253.

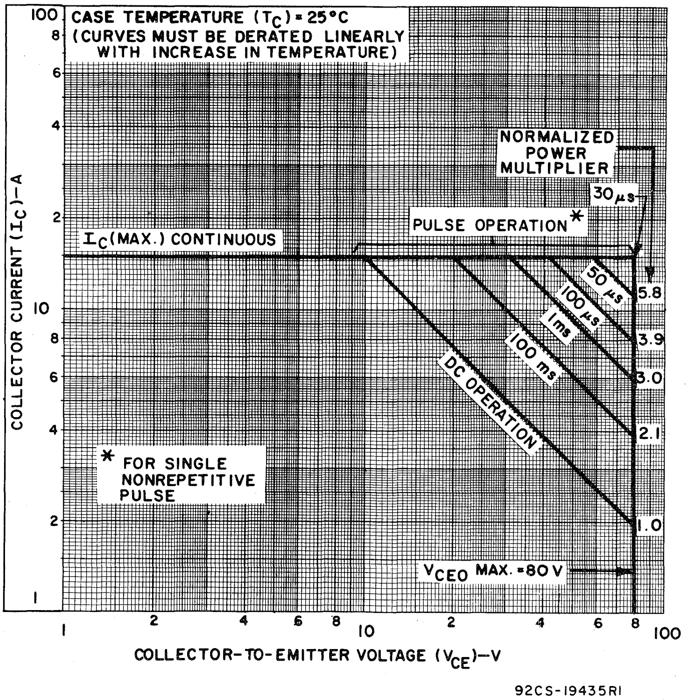


Fig. 10 - Maximum operating areas for 2N6254.

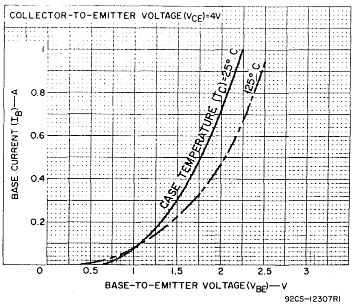


Fig. 11 - Typical input characteristics for 2N3055H, 2N6371, 40251.

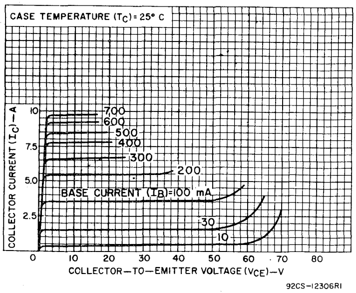


Fig. 12 - Typical output characteristics for 2N3055H, 2N6371.

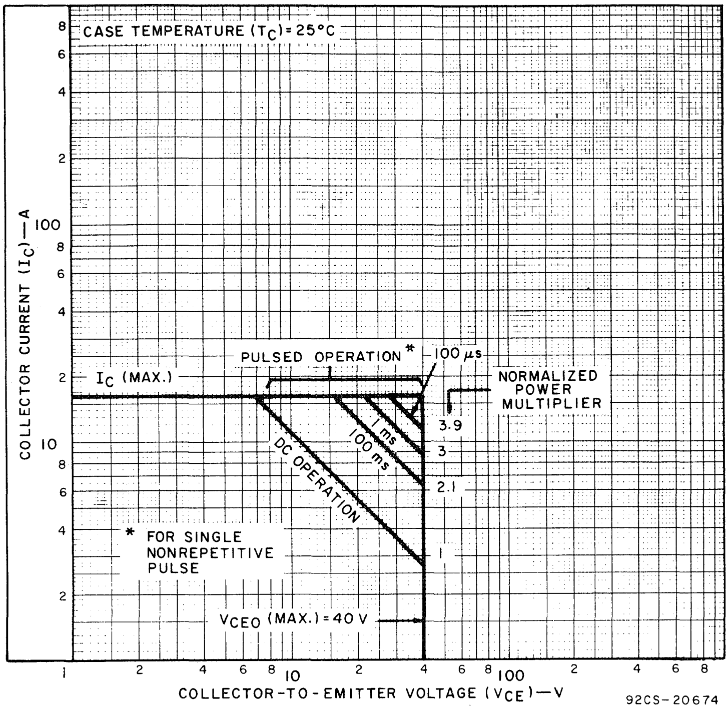


Fig. 13 - Maximum safe area of operation at case temperature of 25°C for 2N6371.

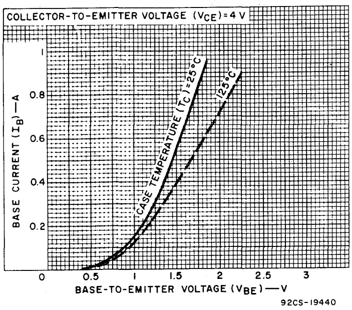


Fig. 14 - Typical input characteristics for 2N6253.

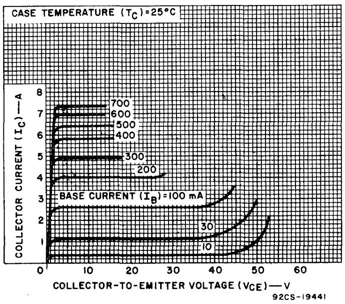


Fig. 15 - Typical output characteristics for 2N6253.

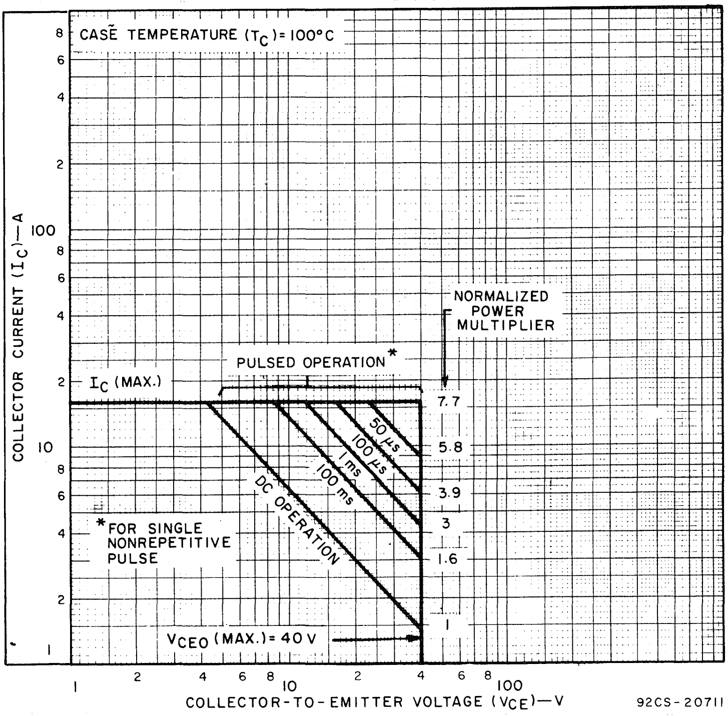


Fig. 16 - Maximum safe area of operation at case temperature of 100°C for 2N6371.

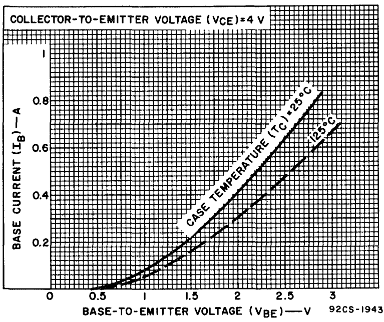


Fig. 17 - Typical input characteristics for 2N6254.

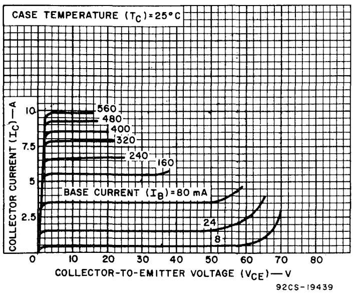


Fig. 18 - Typical output characteristics for 2N6254.

2N3263-2N3266

High-Power, High-Speed, High-Current Silicon N-P-N Power Transistors

Epitaxial Types for Aerospace, Military, and Industrial Applications

Features:

- **Low saturation voltages –**
  - **2N3263 and 2N3265**
    - **V_{CE}(sat) = 0.75 V (max.) at I_C = 15 A**
    - **V_{BE}(sat) = 1.60 V (max.) at I_C = 15 A**
  - **2N3264 and 2N3266**
    - **V_{CE} (sat) = 1.20 V (max.) at I_C = 15 A**
    - **V_{BE} (sat) = 1.80 V (max.) at I_C = 15 A**
- **High reliability and uniformity of characteristics**
- **High power dissipation**
- **Fast rise time at high collector current – 0.2 μs at 10 A (typical)**

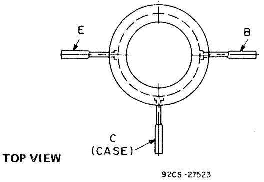
RCA-2N3263, 2N3264, 2N3265, and 2N3266● are n-p-n epitaxial silicon power transistors designed for high-reliability aerospace, military, and industrial equipment. Their high current-handling capability and fast switching speed make them desirable in applications where high circuit efficiency is required.

The 2N3263 and 2N3264 are sealed in flat 3/4-inch-diameter packages with radial leads. Types 2N3265 and 2N3266 utilize the JEDEC TO-63 package.

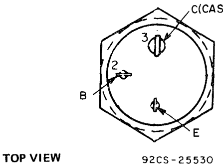
Typical high-speed switching applications for these transistors include switching-control amplifiers, power gates, switching regulators, dc-dc converters, and dc-ac inverters. Other recommended applications include dc-rf amplifiers and power oscillators.

● Formerly RCA Dev. Nos. TA2492, TA2493, TA2494, and TA2495, respectively.

TERMINAL DESIGNATIONS



2N3263, 2N3264
(RADIAL)



2N3265, 2N3266
(JEDEC TO-63)

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		2N3264 2N3266	2N3263 2N3265	
* COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	120	150	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:				
With 1.5 volts (V_{BE}) of reverse bias	V_{CEX}(sus)	120	150	V
With external base-to-emitter resistance (R_{BE}) ≤ 50 Ω	V_{CER}(sus)	80	110	V
* With base open	V_{CEO} (sus)	60	90	V
* EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	7	V
* COLLECTOR CURRENT	I_C	25	25	A
* BASE CURRENT	I_B	10	10	A
* TRANSISTOR DISSIPATION	P_T	*See Figs. 1 & 2*		
* TEMPERATURE RANGE:				
Storage and operating (Junction)		—— −65 to +200 ——		°C
LEAD TEMPERATURE (During soldering):				
At distance ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max.		——— 230 ———		°C

* In accordance with JEDEC registration data format.

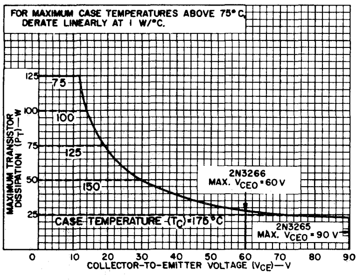


Fig. 1—Rating chart for 2N3265 and 2N3266.

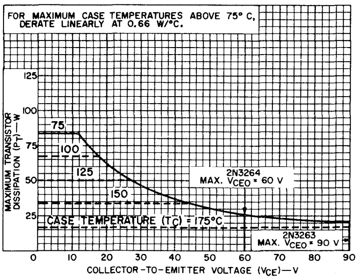


Fig. 2—Rating chart for 2N3263 and 2N3264.

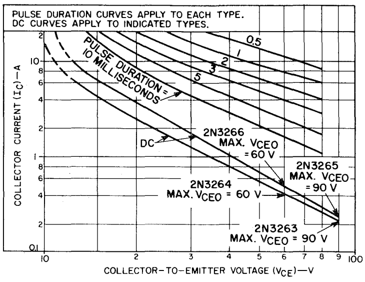


Fig. 3—Safe-operating region as a function of pulse width.

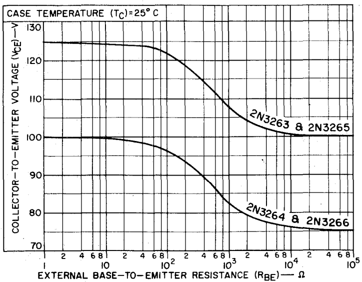


Fig. 4—Typical sustaining voltage vs. base-to-emitter resistance.

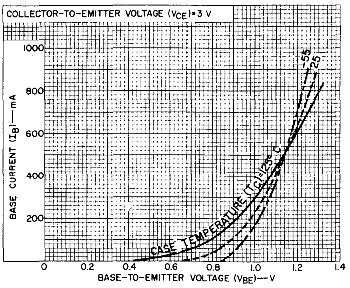


Fig. 5—Typical input characteristics.

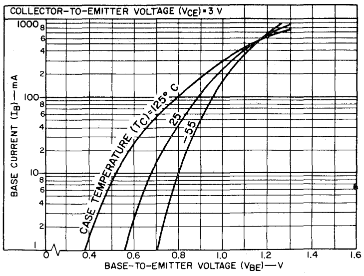


Fig. 6—Typical input characteristics.

2N3263-2N3266

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS						LIMITS				UNITS
		VOLTAGE V dc			CURRENT A dc			2N3264 2N3266		2N3263 2N3265		
		V_{CB}	V_{CE}	V_{EB}	I_E	I_B	I_C	MIN.	MAX.	MIN.	MAX.	
Collector Cutoff Current: With emitter open	I_{CBO}	60 80			0 0			– –	10 –	– –	– 4	mA
At T_C = 125°C		60 80			0 0			– –	10 –	– –	– 4	
* With base reverse-biased	I_{CEX}		120 150	1.5 1.5				– –	20 –	– –	– 20	
* Emitter Cutoff Current:	I_{EBO}			7			0	–	15	–	5	mA
* At T_C = 125°C				7			0	–	15	–	5	
Emitter-to-Base Voltage	V_{EBO}				0.02		0	7	–	7	–	V
Collector-to-Emitter Sustaining Voltage: * With base open	$V_{CEO}(sus)$●					0	0.2	60	–	90	–	V
With external base-to-emitter resistance (R_{BE}) ≤ 50 Ω	$V_{CER}(sus)$●					0	0.2	80	–	110	–	
* Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$●					2 1.2	20 15	– –	1.6 1.2	– –	1 0.75	V
* Base-to-Emitter Saturation Voltage	$V_{BE}(sat)$●					2 1.2	20 15	– –	2.2 1.8	– –	1.8 1.6	V
* DC Forward Current Transfer Ratio	h_{FE}●		3 3 2				5 15 15	35 20 –	– 80 –	40 25 20	– 75 55	
* Second-Breakdown Collector Current: (See Fig. 3) DC forward-biased	$I_{S/b}$▲	50 75						700 –	– –	– 350	– –	mA
* Pulsed, forward-biased, t_p = 250 μs		75						13.3	–	13.3	–	A
* Second-Breakdown Energy With base reverse-biased, and R_{BE} = 20Ω, L = 40μH	$E_{S/b}$**			6			10	2	–	2	–	mJ
* Saturated Switching Time: Turn-on ($t_d + t_r$)	t_{ON}	V_{CC}= 30				1.2♦	15	–	0.5	–	0.5	μs
Storage	t_s					1.2♦	15	–	1.5	–	1.5	
Fall	t_f					1.2♦	15	–	0.5	–	0.5	
* Gain-Bandwidth Product (f = 1 MHz)	f_T		10				3	20	–	20	–	MHz
Collector-to-Base Feedback Capacitance (f = 1 MHz)	C_{ob}	10			0			–	500	–	500	pF
* Thermal Resistance (Junction-to-Case)	$R_{\theta JC}$		10				10	2N3263 2N3264 –	1.5	2N3265 2N3266 –	1	°C/W

* In accordance with JEDEC registration data format.

● Pulsed; pulse duration ≤ 350 μs, duty factor ≤ 2%. CAUTION: The sustaining voltages $V_{CEO}(sus)$ and $V_{CER}(sus)$ MUST NOT be measured on a curve tracer. These sustaining voltages should be measured by means of test circuit.

▲ $I_{S/b}$ is defined as the current at which second breakdown occurs at a specified collector voltage.

** $E_{S/b}$ is defined as the energy at which second breakdown occurs under specified reverse bias conditions. $E_{S/b} = 1/2\ LI^2$, where L is a series load or leakage inductance and I is the collector current.

♦ $I_{B_1} = I_{B_2}$.

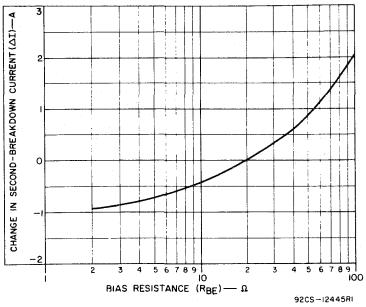


Fig.7—Typical change in $E_{S/b}$ as a function of base-to-emitter resistance.

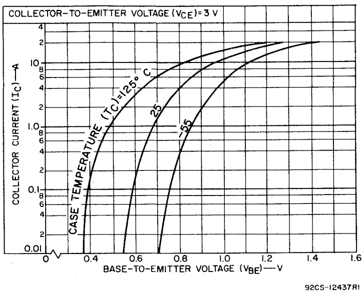


Fig.8—Typical transfer characteristics.

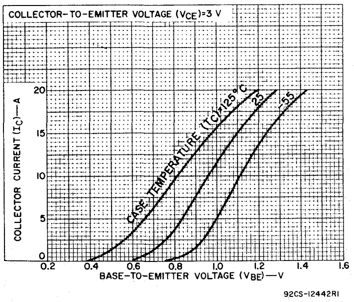


Fig.9—Typical transfer characteristics.

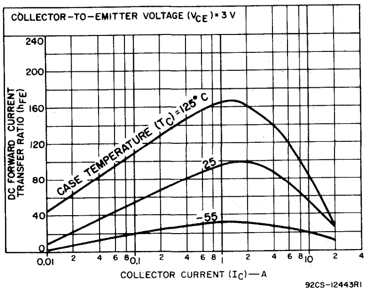


Fig.10—Typical dc beta characteristics (median values).

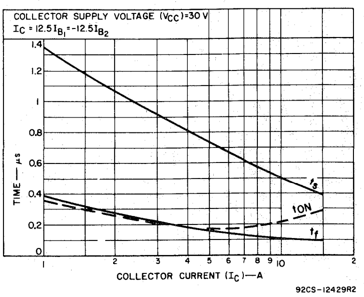


Fig.11—Typical saturated-switching characteristics.

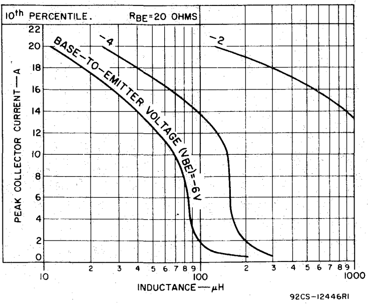


Fig.12—Collector current as a function of inductance (50th percentile).

2N3439; 2N3440; 2N4063; 2N4064; 40385; 40346, V1, V2; 40390; 40412, V1, V2

High-Voltage Silicon N-P-N Transistors

For High-Speed Switching and Linear-Amplifier Applications

These RCA types are epitaxial-base silicon n-p-n transistors with high breakdown voltages, high-frequency response, and fast switching speeds. These transistors are intended for industrial, commercial, and military equipment. Typical applications include high-voltage differential and operational amplifiers, high-voltage inverters, and high-voltage, low-current switching and series regulators.

Types 40346, 40346V1, and 40346V2 are especially useful in such devices as neon indicator and NIXIE® driver circuits and in differential and operational amplifiers. Types 40412, 40412V1, and 40412V2 are especially suited for class-A ac/dc audio-amplifier service.

These transistors are supplied in JEDEC TO-39 hermetic packages or in the TO-39 package with factory-attached mounting flange or heat radiator.

®Nixie is a Registered Trademark of Burroughs Corporation, Electronic Components Division, Plainfield, N.J.

Features:

- **High voltage ratings:**
  V_{CBO} = 450 V max. (2N3439, 2N4063)
  = 300 V max. (2N3440, 2N4064)
  $V_{CEO}(sus)$ = 350 V max. (2N3439, 2N4063)
  = 250 V max. (2N3440, 2N4064)
- **Maximum-area-of-operation curves**
- **Low saturation voltages**
- **Planar construction for low noise and low leakage**

Additional Features for 40385:

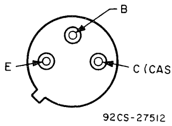
- **High reliability assured by five preconditioning steps**
- **Group A test data in data File 215**

MAXIMUM RATINGS, *Absolute-Maximum Values:*		**2N3439 2N4063 40385**	**2N3440 2N4064 40390**	**40346 40346V1 40346V2**	**40412 40412V1 40412V2**	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	450	300	–	–	V
COLLECTOR-TO-EMITTER VOLTAGE:						
With external base-to-emitter resistance						
(R_{BE}) = 1,000 Ω	$V_{CER}(sus)$	–	–	175	–	V
= 10,000 Ω	$V_{CER}(sus)$	–	–	–	250	V
* With base open	$V_{CEO}(sus)$	350	250	–	–	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	7	–	–	V
*CONTINUOUS COLLECTOR CURRENT ...	I_C	1	1	1	1	A
*CONTINUOUS BASE CURRENT	I_B	0.5	0.5	0.5	0.5	A
TRANSISTOR DISSIPATION:	P_T					
At case temperature up to 25°C		10	10(2N3440)	10(40346)	10(40412)	W
			10(2N4064)	10(40346V2)	10(40412V2)	W
At free-air temperatures up to 25°C		1(40385)	3.5(40390)	4(40346V1)	4(40412V1)	W
At free-air temperatures up to 50°C		1(2N3439)	1(2N3440)	1(40346)	1(40412)	W
At free-air temperatures above 25°C or 50°C		Derate linearly to 200°C				°C
*TEMPERATURE RANGE:						
Storage & Operating (Junction)		−65 to 200				°C
*LEAD TEMPERATURE (During soldering):						
At distances ⩾ 1/32 in (0.79 mm)						
from seating plane for 10 s max.		255				°C

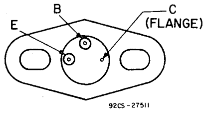
*2N-Series types in accordance with JEDEC registration data

NOTE: P_T value of 10 W at T_C = 25°C and lead temperature of 255°C are registered data for 2N4063 and 2N4064 only.

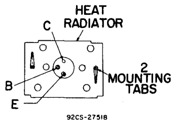
TERMINAL DESIGNATIONS



JEDEC TO-39
2N3439,2N3440,40346
40385,40412



JEDEC TO-39 with Flange
2N4063,2N4064,40346V2,
40412V2



JEDEC TO-39 with Heat Radiator
40390,40346V1,40412V1

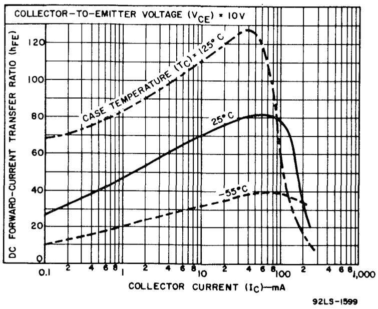


Fig. 1 — Typical dc-beta characteristics for 2N3439, 2N3440, 2N4063, 2N4064 and 40390.

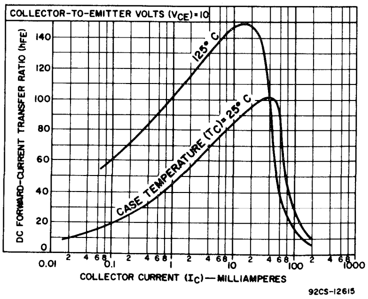


Fig. 2 — Typical dc-beta characteristics for 40346, 40346V1, 40346V2, 40412, 40412V1 and 40412V2.

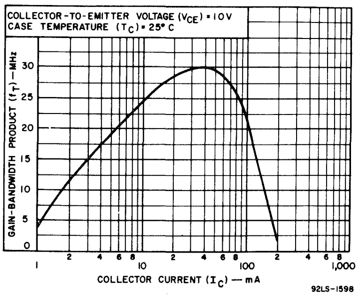


Fig.3— Typical gain-bandwidth product for all types.

2N3439; 2N3440; 2N4063; 2N4064; 40385; 40346, V1, V2; 40390; 40412, V1, V2

ELECTRICAL CHARACTERISTICS, *Case Temperature (T_C) = 25°C, Unless Otherwise Specified*

CHARACTERISTICS	SYMBOL	VOLTAGE V dc		CURRENT mA dc	LIMITS								UNITS
					2N3439 2N4063 40385		2N3440 2N4064 40390		40346 40346V1 40346V2		40412 40412V1 40412V2		
		V_{CE}	V_{BE}	I_C	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
Collector-Cutoff Current: With base open	I_{CEO}	100	–		–	–	–	–	–	5	–	5	μA
		200			–	–	–	50	–	–	–	–	
		300			–	20	–	–	–	–	–	–	
With base reverse-biased:	I_{CEV}	200	– 1.5		–	–	–	–	–	10	–	–	
		300	– 1.5		–	–	–	500	–	–	–	–	
		450	– 1.5		–	500	–	–	–	–	–	–	
At T_C = 150°C		150	– 1.5		–	–	–	–	–	–	–	2	mA
		200	– 1.5		–	–	–	–	–	1	–	–	
With R = 10,000 ohms	I_{CER}	100			–	–	–	–	–	–	–	1	mA
* Collector-Cutoff Current	I_{CBO}	250	–		–	–	–	20[c]	–	–	–	–	μA
		360	–		–	20[c]	–	–	–	–	–	–	
* Emitter-Cutoff Current	I_{EBO}		– 3		–	–	–	–	–	–	–	100	μA
			– 4		–	–	–	–	–	5	–	–	
			– 6		–	20	–	20	–	–	–	–	
DC Forward-Current Transfer Ratio	h_{FE}	10		2	30	–	–	–	–	–	–	–	
		10		10	–	–	–	–	25	–	–	–	
		10		20	40	160	40	160	–	–	–	–	
		20		30	–	–	–	–	–	–	40	–	
Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$			50	350[a]	–	250[a]	–	–	–	–	–	V
Collector-to-Emitter Sustaining Voltage: With external base-to-emitter resistance R_{BE}= 1,000 ohms	$V_{CER}(sus)$			50	–	–	–	–	175[a]	–	–	–	
R_{BE}= 10,000 ohms	$V_{CER}(sus)$			50	–	–	–	–	–	–	250[a]	–	
Base-to-Emitter Voltage	V_{BE}	10		10	–	–	–	–	–	1	–	–	V
* Base-to-Emitter Saturation Voltage I_B = 4 mA	$V_{BE}(sat)$			50	–	1.3	–	1.3	–	–	–	–	V
Collector-to-Emitter Saturation Voltage I_B = 1 mA	$V_{CE}(sat)$			10	–	–	–	–	–	0.5	–	0.5	V
* I_B = 4 mA				50	–	0.5	–	0.5	–	–	–	–	
* Small-Signal Forward-Current Transfer Ratio: f= 5 MHz	h_{fe}	10		10	3	–	3	–	2	–	2	–	
* Output Capacitance: V_{CB} = 10 V, f = 1 MHz	C_{ob}				–	10	–	10	–	10	–	10	pF
Second-Breakdown Current t_p = 0.4 s	$I_{S/b}$	200			–	50[b]	–	50[b]	–	–	50	–	mA
Thermal Resistance: Junction-to-case	$R_{\theta JC}$				–	17.5	–	17.5	15 max. (40346) (40346V2)		15 max. (40412) (40412V2)		°C/W
Junction-to-free air	$R_{\theta JFA}$				–	–	–	–	45 max. (40346V1)		45 max. (40412V1)		

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[a] CAUTION: The sustaining voltages, $V_{CEO}(sus)$ and $V_{CER}(sus)$, MUST NOT be measured on a curve tracer.

[b] 2N-Series types.

[c] 2N3439 and 2N3440 only.

*2N-Series types in accordance with JEDEC registration data.

2N3439; 2N3440; 2N4063; 2N4064; 40385; 40346, V1, V2; 40390; 40412, V1, V2

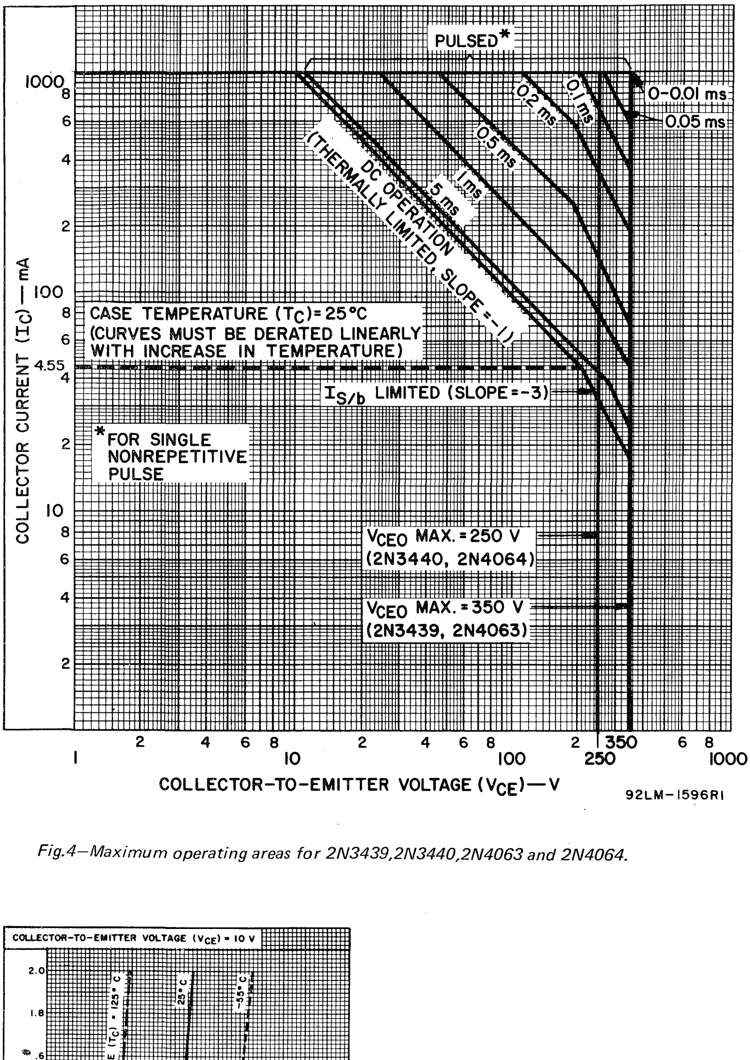

Fig.4—Maximum operating areas for 2N3439,2N3440,2N4063 and 2N4064.

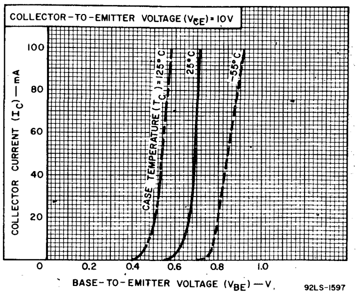

Fig. 5 — Typical transfer characteristics for 2N3439, 2N3440, 2N4063, 2N4064 and 40390.

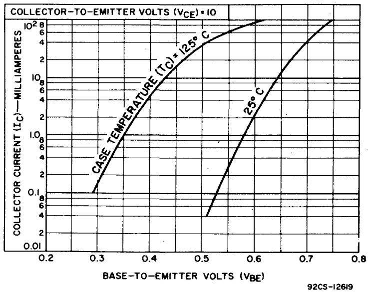

Fig. 6 — Typical transfer characteristics for 40346, 40346V1, 40346V2, 40412, 40412V1 and 40412V2.

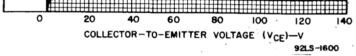

Fig. 7 — Typical output characteristics for 2N3439, 2N3440, 2N4063, 2N4064 and 40390.

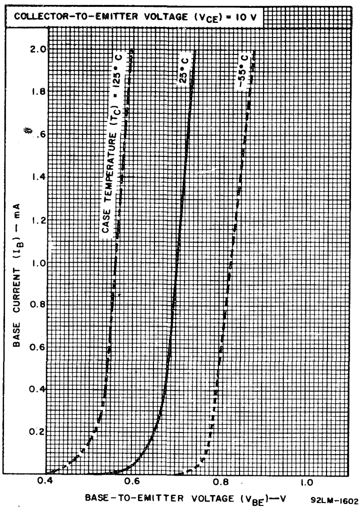

Fig. 8 — Typical input characteristics for 2N3439, 2N3440, 2N4063, 2N4064 and 40390.

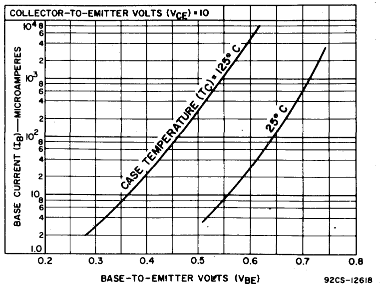

Fig. 9 — Typical input characteristics for 40346, 40346V1, 40346V2, 40412, 40412V1 and 40412V2.

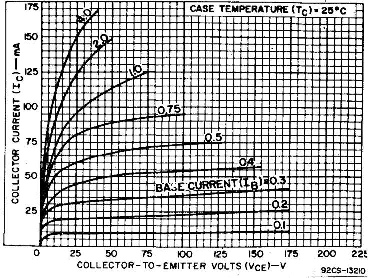

Fig. 10 — Typical output characteristics for 40346, 40346V1, 40346V2, 40412, 40412V1 and 40412V2.

2N3441, 2N6263, 2N6264, 40373, 40912, 40913

Hometaxial-Base Medium-Power Silicon N-P-N Transistors

Rugged Devices for Intermediate, Power Applications in Industrial and Commercial Equipment

RCA 2N3441, 2N6263, and 2N6264 are hometaxial-base silicon n-p-n transistors intended for a wide variety of medium to-high power, high-voltage applications. These types are supplied in the JEDEC TO-66 hermetic package.

Types 40373, 40912, and 40913 are the 2N3441, 2N6263, and 2N6264 with factory-attached heat-radiators intended for printed-circuit-board applications.

Features:

- 2N6264: premium type from 2N3441 family
- Maximum safe-area-of-operation curves for dc and pulse operation
- High voltage ratings
- Low saturation voltages
- Thermal-cycling rating curves

Applications:

- Series and shunt regulators
- High-fidelity amplifiers
- Power switching circuits
- Solenoid drivers

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		2N6263 40912	2N3441 40373	2N6264 40913	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	140	160	170	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:					
* With base open	$V_{CEO}(sus)$	120	140	150	V
With external base-to-emitter resistance (R_{BE}) = 100Ω	$V_{CER}(sus)$	130	150	160	V
With base reverse-biased (V_{BE} = -1.5 V)	$V_{CEV}(sus)$	140	160	170	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	7	7	V
*CONTINUOUS COLLECTOR CURRENT	I_C	3	3	3	A
PEAK COLLECTOR CURRENT		4	4	4	A
*CONTINUOUS BASE CURRENT	I_B	2	2	2	A
TRANSISTOR DISSIPATION:	P_T				
* At case temperature up to 25°C		20 (2N6263)	25 (2N3441)	50 (2N6264)	W
At ambient temperatures up to 25°C		5.8 (40912)	5.8 (40373)	5.8 (40913)	W
* At temperatures above 25°C		Derate linearly to 200°C			
*TEMPERATURE RANGE:					
Storage & Operating (Junction)		-65 to 200			°C
*PIN TEMPERATURE (During Soldering):					
At distances ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max.		235			°C

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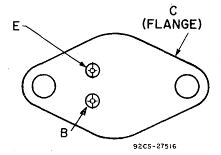
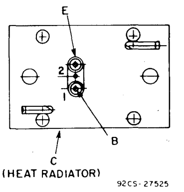
*In accordance with JEDEC registration data format JS-6 RDF-2

TERMINAL DESIGNATIONS



JEDEC TO-66
2N3441,2N6263,2N6264



JEDEC TO-66 with Heat Radiator
40373,40912,40913

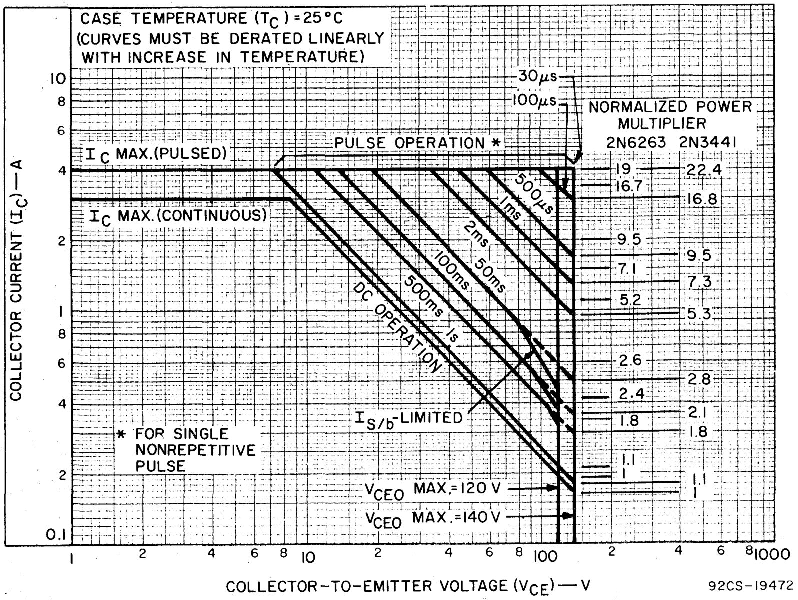


Fig. 1—Maximum operating areas for 2N3441 and 2N6263.

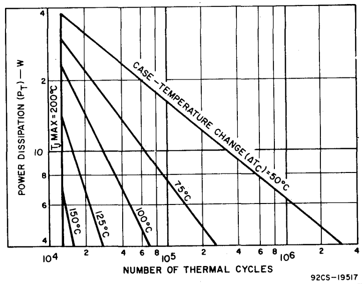


Fig.2—Thermal-cycle rating chart for 2N6264.

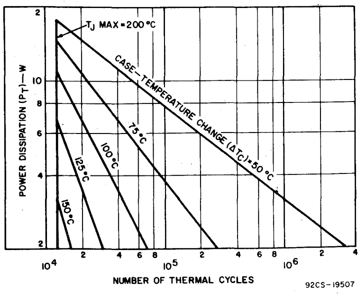


Fig.3—Thermal-cycle rating chart for 2N3441.

2N3441, 2N6263, 2N6264, 40373, 40912, 40913

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C, Unless Otherwise Specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS						UNITS
		VOLTAGE V dc		CURRENT A dc		2N6263 40912		2N3441 40373		2N6264 40913		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
Collector-Cutoff Current:												
* With base open	I_{CEO}	100		-	0	–	5	–	–	–	–	mA
		130			0	–	–	–	–	–	1	
		140			0	–	–	–	100	–	–	
Collector-Cutoff Current: With base-emitter junction reversed biased	I_{CEX}	120	−1.5			–	2*	–	–	–	–	mA
		140	−1.5			–	–	–	5*	–	–	
		140	−1.5			–	–	–	1	–	–	
		150	−1.5			–	–	–	–	–	0.05*	
	I_{CEX} (T_C = 150°C)	120	−1.5			–	10*	–	–	–	–	
		140	−1.5			–	–	–	6*	–	–	
		140	−1.5			–	–	–	5	–	–	
		150	−1.5			–	–	–	–	–	1*	
* Emitter-Cutoff Current	I_{EBO}		−5			–	2	–	–	–	–	mA
			−7			–	–	–	1	–	0.2	
Collector-to-Emitter Sustaining Voltage:[a]												
* With base open	V_{CEO}(sus)			0.1^b	0	120	–	140	–	150	–	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	V_{CER}(sus)			0.1		130	–	150	–	160	–	
With base-emitter junction reversed biased	V_{CEV}(sus)		−1.5	0.1		140	–	160	–	170	–	
* DC Forward-Current Transfer Ratio	h_{FE}	2		1^b		–	–	–	–	20	60	
		2		3^b		3	–	–	–	5	–	
		4		0.5^b		20	100	25	100	–	–	
		4		2.7^b		–	–	5	–	–	–	
Collector-to-Emitter Saturating Voltage	V_{CE}(sat)			0.5^b	0.05	–	1.2*	–	1	–	–	V
				1^b	0.1	–	–	–	–	–	0.5*	
				2.7^b	0.9	–	–	–	6*	–	–	
Base-to-Emitter Voltage	V_{BE}	2		1^b		–	–	–	–	–	1.5*	V
		4		0.5^b		–	2*	–	1.7	–	–	
		4		2.7^b		–	–	–	6*	–	–	
* Magnitude of Common-Emitter, Small-Signal, Short-Circuit Forward Current Transfer Ratio (f = 0.4 MHz)	$\|h_{fe}\|$	4		0.5		5	–	5	–	5	–	
Gain-Bandwidth Product	f_T	4		0.2		200	–	200	–	200	–	kHz
* Common-Emitter, Small-Signal, Short-Circuit Forward Current Transfer Ratio (f = 1 kHz)	h_{fe}	4		0.1		25	–	–	–	25	–	
		4		0.5		–	–	15	75	–	–	
Forward-Bias Second Breakdown Collector Current, Pulse Duration (non-repetitive) = 1 s	$I_{S/b}$	120				0.167	–	–	–	–	–	A
		120				–	–	–	–	0.417	–	
		120				–	–	0.21	–	–	–	
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$					8.75 (max.) 2N6263		7 (max.) 2N3441		3.5 (max.) 2N6264		°C/W
Junction-to-Ambient	$R_{\theta JA}$					30 (max.) 40912		30 (max.) 40373		30 (max.) 40913		

*In accordance with JEDEC registration data format (JS-6 RDF-2).

[a] **CAUTION**: The sustaining voltage V_{CEO}(sus), V_{CER}(sus), and V_{CEV}(sus) MUST NOT be measured on a curve tracer.

[b] Pulsed, pulse duration = 300 μs; duty factor ≤ 2 %.

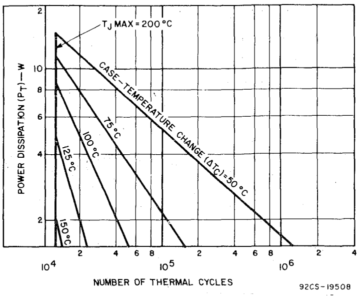


Fig.4—Thermal-cycle rating chart for 2N6263.

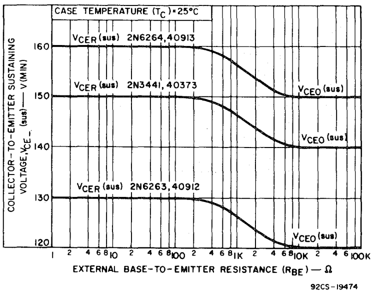


Fig.5—Sustaining voltage vs. base-to-emitter resistance for all types.

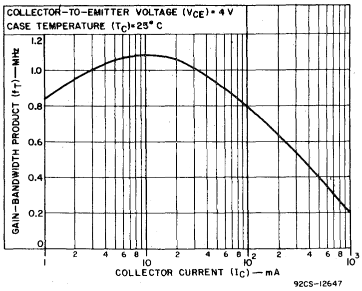


Fig.6—Typical gain-bandwidth product for all types.

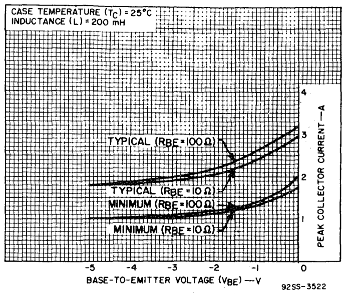


Fig.7—Reverse-bias second-breakdown characteristics for all types.

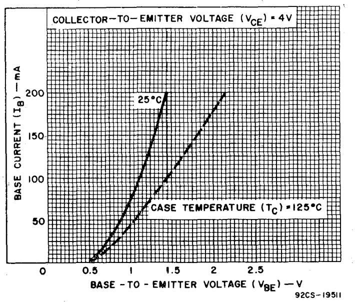


Fig.8—Typical input characteristics for 2N6263 and 40912.

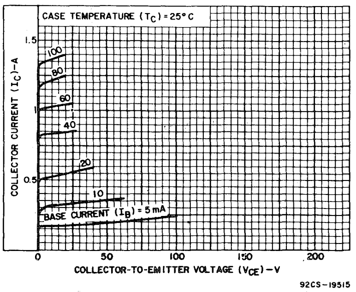


Fig.9—Typical output characteristics for 2N6263 and 40912.

2N3441, 2N6263, 2N6264, 40373, 40912, 40913

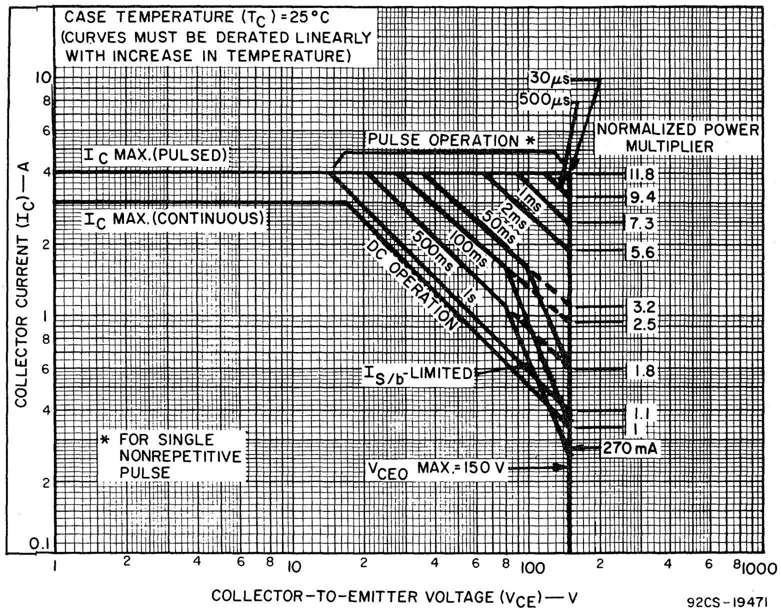


Fig. 10—Maximum operating areas for 2N6264.

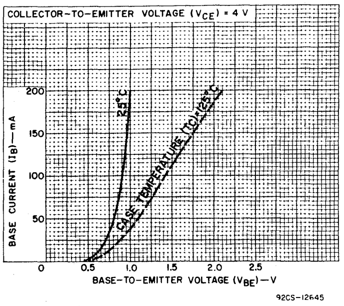


Fig. 11—Typical input characteristics for 2N3441 and 40373.

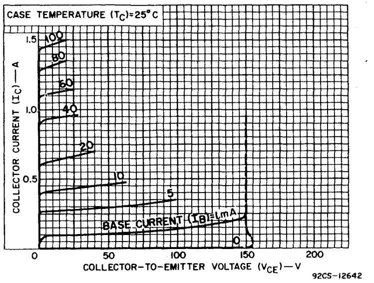


Fig. 12—Typical output characteristics for 2N3441 and 40373.

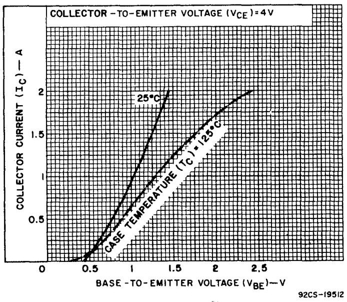


Fig. 13—Typical transfer characteristics for 2N6263 and 40912.

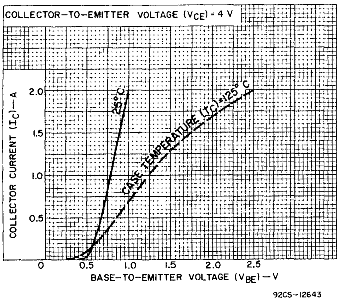


Fig. 14—Typical transfer characteristics for 2N3441 and 40373.

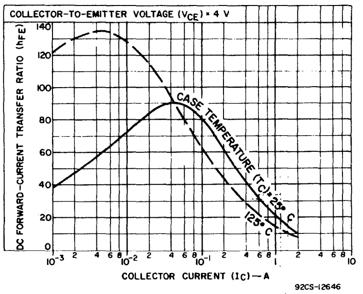


Fig. 15—Typical dc-beta characteristics for 2N3441 and 40373.

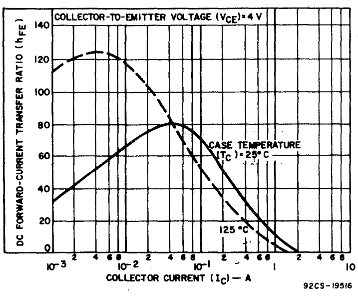


Fig. 16—Typical dc-beta characteristics for 2N6263 and 40912.

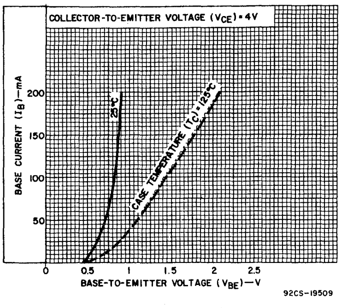


Fig. 17—Typical input characteristics for 2N6264 and 40913.

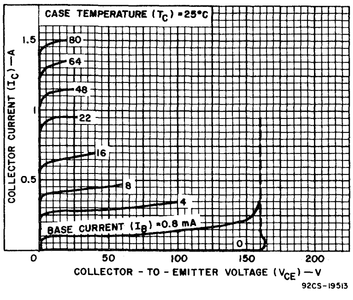


Fig. 18—Typical output characteristics for 2N6264 and 40913.

2N3441, 2N6263, 2N6264, 40373, 40912, 40913

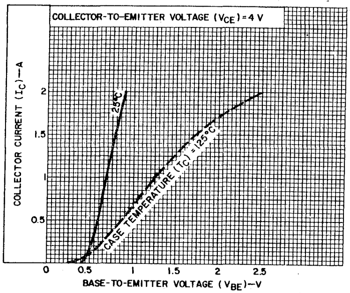


Fig. 19—Typical transfer characteristics for 2N6262 and 40913.

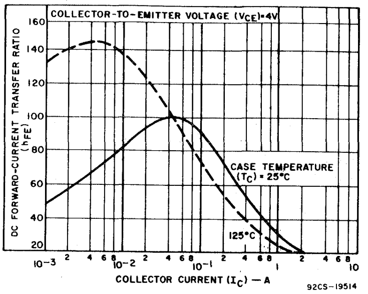


Fig. 20—Typical dc-beta characteristics for 2N6264 and 40913.

2N3442, 2N4347, 2N6262

Hometaxial-Base High-Voltage Silicon N-P-N Transistors

Rugged High-Power Devices for Applications in Industrial and Commercial Equipment

RCA 2N3442, 2N4347, and 2N6262 are hometaxial-base, silicon n-p-n transistors intended for a wide variety of high-power, high-voltage applications. Typical applications for these transistors include power-switching circuits, audio amplifiers, series- and shunt-regulator driver and output stages, dc-to-dc converters, inverters, and solenoid (hammer)/relay driver service.

These devices employ the popular JEDEC TO-3 package; they differ in maximum ratings for voltage, current, and power.

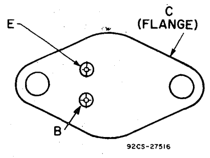
Features:

- **Low saturation voltages**
- **Thermal-cycle rating charts**
- **High dissipation capability – 100 W (2N4347)**
  – 117 W (2N3442)
  – 150 W (2N6262)
- **Maximum area-of-operation curves for dc and pulse operation.**

Applications:

- **Series and shunt regulators**
- **High-fidelity amplifiers**
- **Power-switching circuits**

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, ***Absolute-Maximum Values:***		**2N4347**	**2N3442**	**2N6262**	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	140	160	170	V
COLLECTOR-TO-EMITTER VOLTAGE:					
* With base open	V_{CEO}	120	140	150	V
With reverse bias (V_{BE}) of −1.5 V	V_{CEV}	140*	160	170	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	7	7	V
*COLLECTOR CURRENT:	I_C				
Continuous		5	10	10	A
Peak		10*	15	15	A
*BASE CURRENT:	I_B				
Continuous		3	7	7	A
Peak		8*	–	–	A
*TRANSISTOR DISSIPATION:	P_T				
At case temperature up to 25°C		100	117	150	W
At case temperatures above 25°C		Derate linearly to 200°C			
*TEMPERATURE RANGE:					
Storage & Operating (Junction)		←— −65 to +200 —→			°C
*PIN TEMPERATURE (During Soldering):					
At distances ≥1/32 in. (0.8 mm) from case for 10 s max.		235	235	235	°C

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*In accordance with JEDEC registration data format (JS-6, RDF-2).

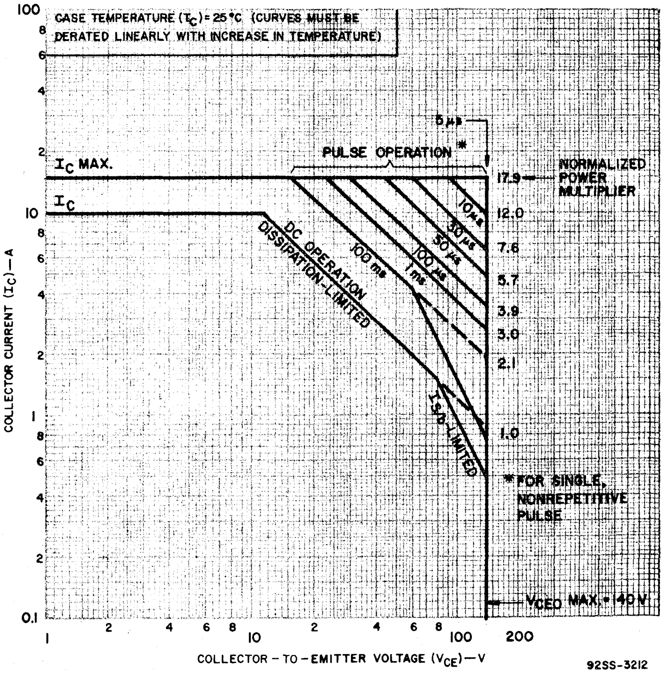

Fig. 1—Maximum operating areas for 2N3442.

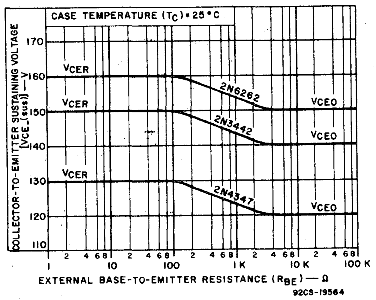

Fig. 2—Sustaining voltage vs. base-to-emitter resistance for all types.

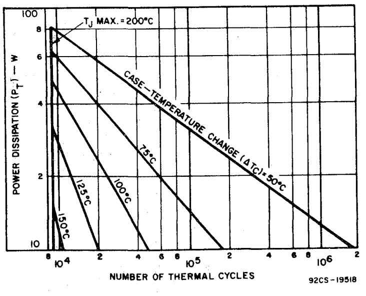

Fig. 3—Thermal-cycle rating chart for 2N3442.

2N3442, 2N4347, 2N6262

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS						UNITS
		VOLTAGE V dc		CURRENT A dc		2N4347		2N3442		2N6262		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
Collector Cutoff Current: With emitter open (V_{CB} = 140 V)	I_{CBO}					–	–	–	1*	–	1	mA
* With base-emitter junction reverse-biased	I_{CEV}	120	–1.5			–	2	–	–	–	–	mA
		140	–1.5			–	–	–	5	–	–	
		150	–1.5			–	–	–	–	–	0.1	
* With base-emitter junction reverse-biased and T_C = 150°C	I_{CEV}	125	–1.5			–	10	–	–	–	–	mA
		140	–1.5			–	–	–	30	–	–	
		150	–1.5			–	–	–	–	–	2	
* With base open	I_{CEO}	100				–	200	–	–	–	–	mA
		110				–	–	–	–	–	1	
		140				–	–	–	200	–	–	
* Emitter Cutoff Current	I_{EBO}		–7	0		–	5	–	5	–	0.2	mA
* DC Forward Current Transfer Ratio	h_{FE}	2		3^a		–	–	–	–	20	70	
		2		10^a		–	–	–	–	5	–	
		4		2^a		15	60	–	–	–	–	
		4		3^a		–	–	20	70	–	–	
		4		5^a		10	–	–	–	–	–	
		4		10^a		–	–	7.5	–	–	–	
Collector-to-Emitter Sustaining Voltage: With base-emitter junction reverse-biased	$V_{CEV}(sus)$		–1.5	0.1		140	–	160	–	–	–	V
			–1.5	0.2		–	–	–	–	170	–	
With external base-to-emitter resistance (R_{BE}) = 100Ω	$V_{CER}(sus)$			0.1		130	–	–	–	–	–	V
				0.2		–	–	150	–	160	–	
* With base open	$V_{CEO}(sus)$			0.2^a	0	120	–	140	–	–	–	V
				0.2^a	0	–	–	–	–	150	–	
* Base-to-Emitter Voltage	V_{BE}	2		3^a		–	–	–	–	–	1	V
		4		3^a		–	–	1.7	–	–	–	
		4		2^a		–	2	–	–	–	–	
		4		5^a		–	3	–	–	–	–	
		4		10^a		–	–	–	5.7	–	–	
* Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$			2^a	0.2	–	1	–	–	–	–	V
				3^a	0.3	–	–	–	1	–	0.5	
				5^a	0.63	–	2	–	–	–	–	
				10^a	2	–	–	–	5	–	–	
Power Rating Test	PRT	67		1.5		1	–	–	–	–	–	s
		78		1.5		–	–	1	–	–	–	
		100		1.5		–	–	–	–	1	–	
* Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio: f = 50 kHz	$\lvert h_{fe} \rvert$	4		0.5		40	–	–	–	–	–	
f = 40 kHz	$\lvert h_{fe} \rvert$	4		1		–	–	–	–	2	–	
		4		2		–	–	2	–	–	–	
* Common-Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio (f = 1 kHz)	h_{fe}	4		0.5		40	–	–	–	–	–	
		4		1		–	–	–	–	10	–	
		4		2		–	–	12	72	–	–	
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$					–	1.75	–	1.5	–	1.17	°C/W

*In accordance with JEDEC registration data format JS-6 RDF-2

[a] Pulse test; pulse duration = 300 μs,rep. rate = 60 Hz

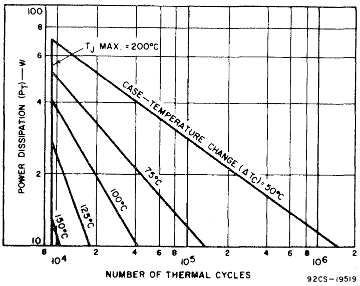

Fig.4—Thermal-cycle rating chart for 2N4347.

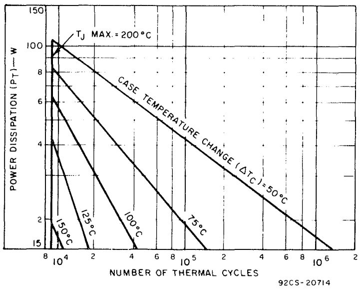

Fig.5—Thermal-cycle rating chart for 2N6262.

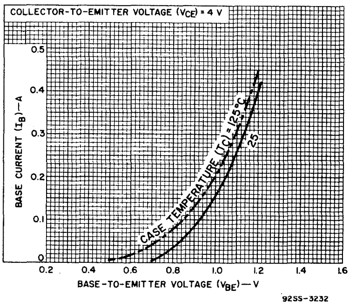

Fig.6—Typical input characteristics for 2N3442.

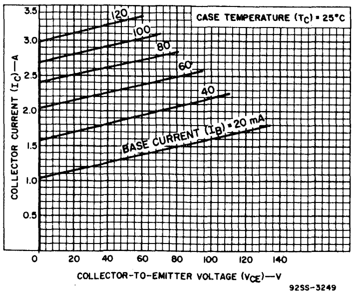

Fig.7—Typical large-signal output characteristics for 2N3442.

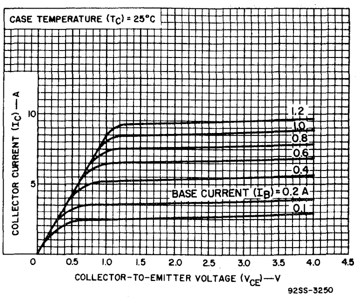

Fig.8—Typical small-signal output characteristics for 2N3442.

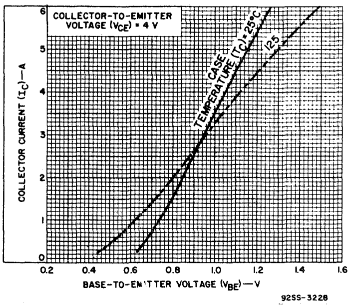

Fig.9—Typical transfer characteristics for 2N3442 and 2N4347.

2N3442, 2N4347, 2N6262

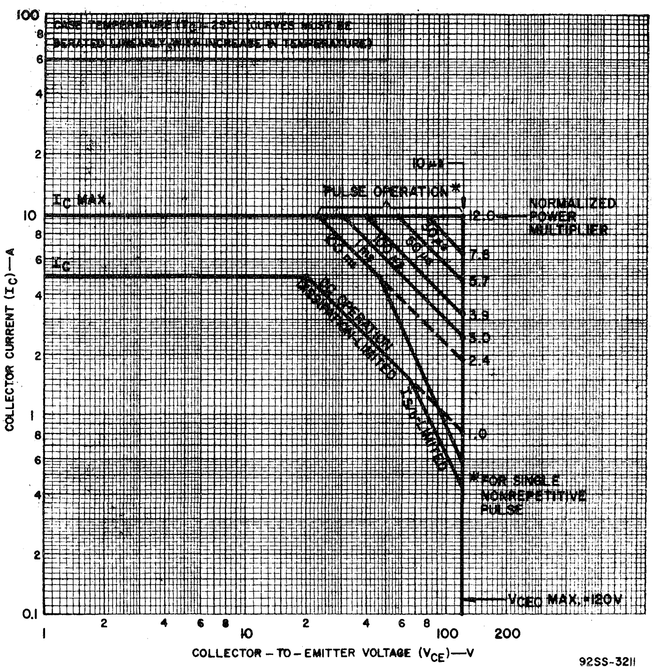

Fig. 10—Maximum operating areas for 2N4347.

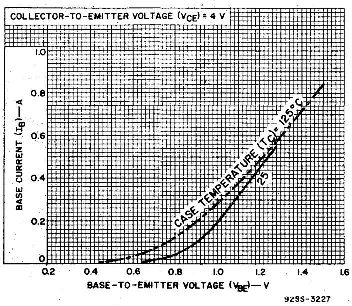

Fig. 11—Typical input characteristics for 2N4347.

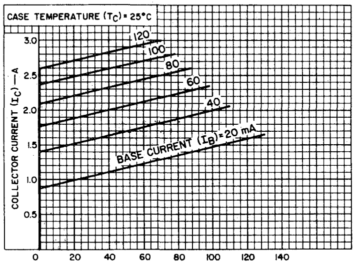

Fig. 13—Typical large-signal output characteristics for 2N4347.

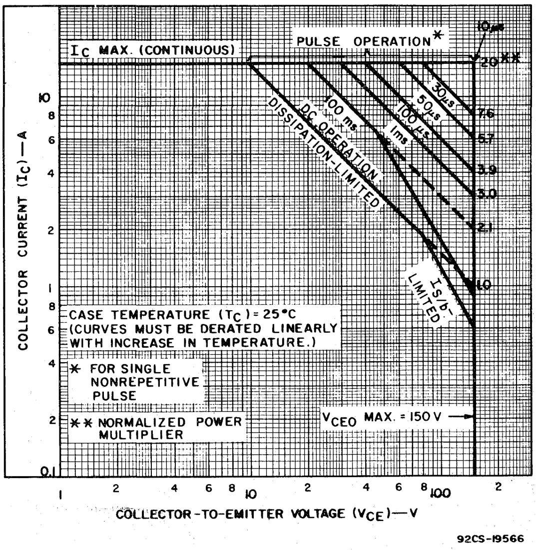

Fig. 12—Maximum operating areas for 2N6262.

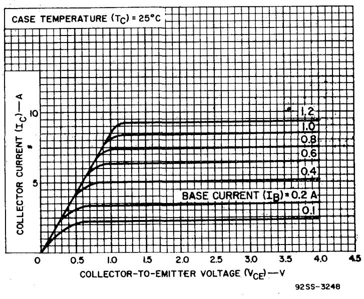

Fig. 14—Typical small-signal output characteristics for 2N4347.

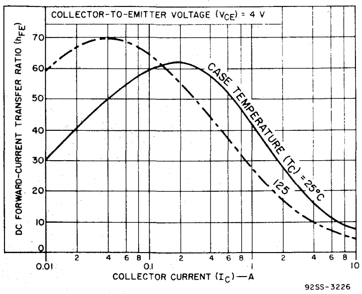

Fig. 15—Typical dc beta characteristics for 2N4347.

2N3442, 2N4347, 2N6262

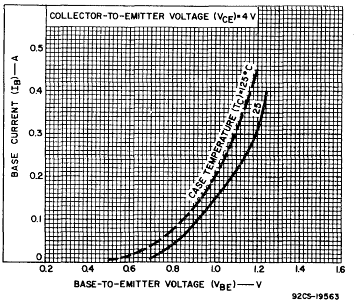

Fig.16—Typical input characteristics for 2N6262.

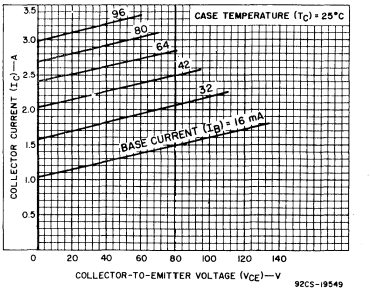

Fig.17—Typical large-signal output characteristics for 2N6262.

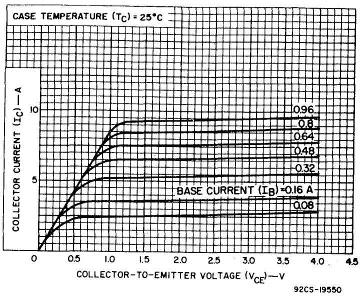

Fig.18—Typical small-signal output characteristics for 2N6262.

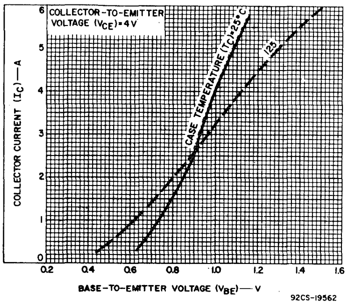

Fig.19—Typical transfer characteristics for 2N6262.

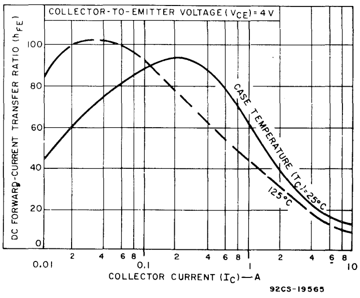

Fig.20—Typical dc beta characteristics for 2N6262.

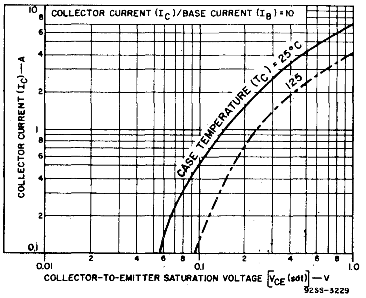

Fig.21—Typical saturation-voltage characteristics for all types.

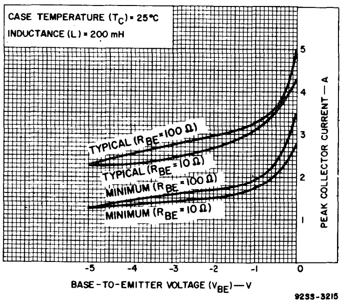

Fig.22—Reverse-bias, second-breakdown characteristics for all types.

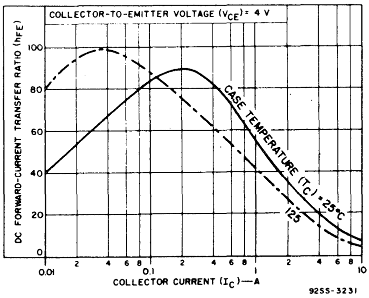

Fig. 23 - Typical dc beta characteristics for 2N3442.

2N3583-2N3585, 2N4240, 40374

High-Voltage Silicon N-P-N Transistors

For High-Speed Switching, Linear-Amplifier Applications, and Off-Line Switching-Regulator Type Power-Supply Applications

These RCA types are silicon n-p-n transistors with high breakdown voltages and fast switching speeds.

Typical applications for these transistors include high-voltage operational amplifiers, high-voltage switches, switching regulators, converters, inverters, deflection- and hi-fi amplifiers.

These transistors are also intended for a wide variety of applications in ac/dc commercial equipment.

Types 2N3583, 2N3584, 2N3585, and 2N4240 are supplied in hermetic JEDEC TO-66 packages. Type 40374 is a 2N3583 with a factory-attached heat radiator.

Features for JEDEC Types:

- **100-percent tested to assure freedom from second breakdown in both forward- and reverse-bias conditions when operated within specified limits**
- **Economy types for ac/dc circuits**
- **Fast turn-on time at high collector current**

MAXIMUM RATINGS, *Absolute-Maximum Values:*		**2N3583**	**2N3584**	**2N3585 2N4240**	**40374**	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	250	375	500	250	V
*COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:						
With base open	$V_{CEO}(sus)$	175	250	300	175	V
With external base-to-emitter resistance (R_{BE}) ⩽ 50Ω	$V_{CER}(sus)$	–	–	–	–	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	6	6	6	6	V
*CONTINUOUS COLLECTOR CURRENT	I_C	1	2	2	2	A
*PEAK COLLECTOR CURRENT	I_{CM}	5	5	5	5	A
*CONTINUOUS BASE CURRENT	I_B	1	1	1	1	A
*TRANSISTOR DISSIPATION	P_T					
At case temperature (T_C) = 25°C		35	35	35	–	W
At ambient temperature (T_A) = 25°C		–	–	–	5.8	W
At case temperatures above 25°C		Derate linearly at 0.2 W/°C				
For other conditions		Derate linearly to 200°C				
*TEMPERATURE RANGE:						
Storage & Operating (Junction)		–65 to 200				°C
*PIN TEMPERATURE:						
1/16 in. (1.58 mm) from seating plane for 10 s max.		235	235	235	235	°C

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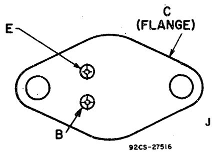
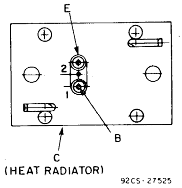
*In accordance with JEDEC registration data format JS-6 RDF-2 (2N3583), JS-6 RDF-1 (2N3584, 2N3585, 2N4240).

TERMINAL DESIGNATIONS



JEDEC TO-66 2N3583, 2N3584, 2N3585, 2N4240, 40850



JEDEC TO-66 with Heat Radiator 40374

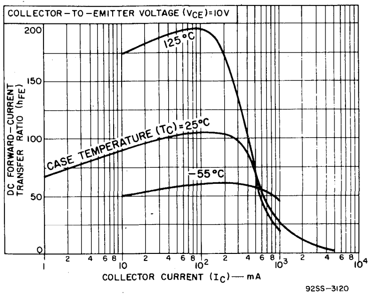


Fig.1—Typical dc beta vs. collector current for 2N3583, 2N4240 and 40374.

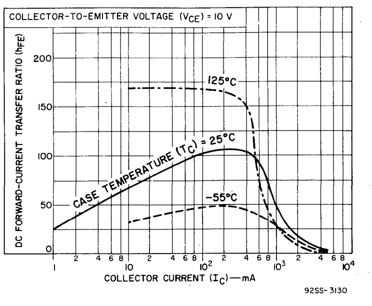


Fig.2—Typical dc beta vs. collector current for 2N3584 and 2N3585.

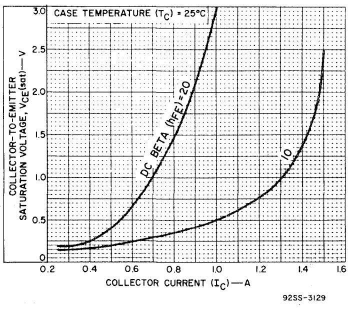


Fig.3—Typical collector-to-emitter saturation voltage vs. current for 2N3584 and 2N3585.

2N3583-2N3585, 2N4240, 40374

ELECTRICAL CHARACTERISTICS *at Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTICS	SYMBOL	TEST CONDITIONS					LIMITS								UNITS
		VOLTAGE V dc		CURRENT mA dc			2N3583 40374		2N3584		2N3585		2N4240		
		V_{CE}	V_{BE}	I_C	I_E	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
* Collector-Cutoff Current	I_{CEO}	150				0	–	10	–	5	–	5	–	5	mA
* Collector-Cutoff Current	I_{CEV}	225	−1.5				–	1.0	–	–	–	–	–	–	mA
		340	−1.5				–	–	–	1.0	–	–	–	–	
		450	−1.5				–	–	–	–	–	1.0	–	2.0	
At T_C = 150°C	I_{CEV}	225	−1.5				–	3	–	–	–	–	–	–	mA
		300	−1.5				–	–	–	3	–	3	–	5.0	
* Emitter-Cutoff Current	I_{EBO}		−6	0			–	5.0	–	0.5	–	0.5	–	0.5	mA
* DC Forward-Current Transfer Ratio	h_{FE}	2		750^a			–	–	–	–	–	–	10	100	
		2		1A^a			–	–	8	80	8	80	–	–	
		10		100^a			40	–	40	–	40	–	40	–	
		10		750^a			40	200	–	–	–	–	–	–	
		10		750^a			–	–	–	–	–	–	30	150	
		10		1A			10	–	25	100	25	100	–	–	
Collector-to-Emitter Sustaining Voltage: With base open	V_{CEO}(sus)			200		0	175●	–	250●	–	300●	–	300●	–	V
With external base-to-emitter resistance (R_{BE})=200Ω	V_{CER}(sus)			200			250●	–	300●	–	400●	–	400●	–	
Emitter-to-Base Voltage	V_{EBO}			0	5		–	–	–	–	–	–	–	–	V
* Base-to-Emitter Saturation Voltage	V_{BE}(sat)			750^a		75	–	–	–	–	–	–	–	1.8	V
				1A^a		100	–	1.4	–	1.4	–	1.4	–	–	
				2A^a		400	–	–	–	–	–	–	–	–	
* Collector-to-Emitter Saturation Voltage	V_{CE}(sat)			750^a		75	–	–	–	–	–	–	–	1.0	V
				1A^a		125	–	5	–	0.75	–	0.75	–	–	
				2A^a		400	–	–	–	–	–	–	–	–	
Small-Signal Forward Current Transfer Ratio f = 5 MHz	h_{fe}	10		200			3	–	3	–	3	–	3	–	
* f = 1 kHz		30		100			25	350	–	–	–	–	–	–	
Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio f = 5 MHz	$\|h_{fe}\|$	10		200			2	–	2	–	2	–	3	–	
Output Capacitance: V_{CB}=10 V, f = 1 MHz	C_{obo}				0		–	120	–	120	–	120	–	120	pF
Second-Breakdown Collector Current With base forward-biased**	$I_{S/b}$	100					350	–	350	–	350	–	350	–	mA
Second-Breakdown Energy with base reverse-biased R_{BE} = 20Ω, L = 100 µH	$E_{S/b}$			2			50	–	200	–	200	–	50	–	µJ
R_{BE} = 20Ω; L = 100 µH			−4	2A pk			–	–	–	–	–	–	–	–	
* Saturated Switching Time (V_{CC}=200 V): Rise Time (See Figs. 13 & 16)	t_r			1A		100	–	–	–	3	–	3	–	–	µs
				750		75	–	–	–	–	–	–	–	0.5	
* Storage Time (See Figs. 14 & 16)	t_s			1A		100	–	–	–	4	–	4	–	–	
				750		75	–	–	–	–	–	–	–	6	
Fall Time (See Figs. 15 & 16)	t_f			750		75	–	–	–	–	–	–	–	3	
				1A		100	–	–	–	3	–	3	–	–	
* Thermal Resistance: Junction-to-Case	$R_{\theta JC}$						5 (Max.) 2N3583		–	5	–	5	–	5	°C/W
Junction-to-Ambient	$R_{\theta JA}$						70 (Max.) 2N3583		–	70	–	70	–	70	
							30 (Max.) 40374		–	–	–	–	–	–	

* In accordance with JEDEC registration data formal JS-6 RDF-2 (2N3583), JS-6 RDF-1 (2N3584, 2N3585, 2N4240)

● **CAUTION:** The sustaining voltages V_{CEO}(sus) and V_{CER}(sus) **MUST NOT** be measured on a curve tracer.

**Specified value of $I_{S/b}$ for given value of V_{CE} as base voltage is increased from zero in a positive direction.

^{a} Pulsed, pulse duration = 300 µs; duty factor ⩽ 2%.

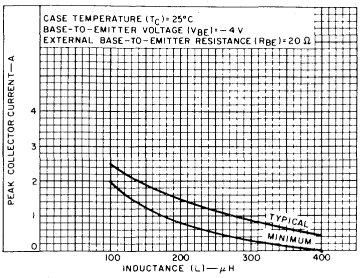


Fig.4—Reverse-bias second breakdown characteristics for 2N3584 and 2N3585.

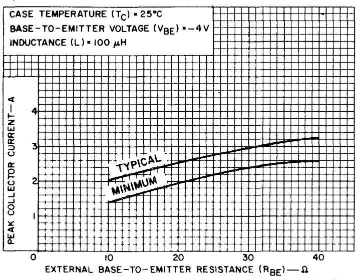


Fig.5—Reverse-bias second breakdown characteristics for 2N3584 and 2N3585.

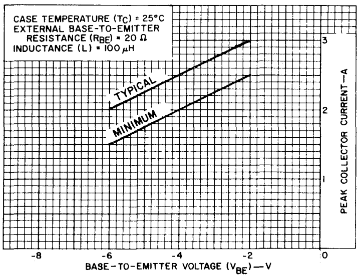


Fig.6—Reverse-bias second breakdown characteristics for 2N3584 and 2N3585.

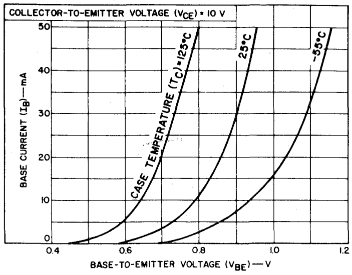


Fig.7—Typical input characteristics for all types.

2N3583-2N3585, 2N4240, 40374

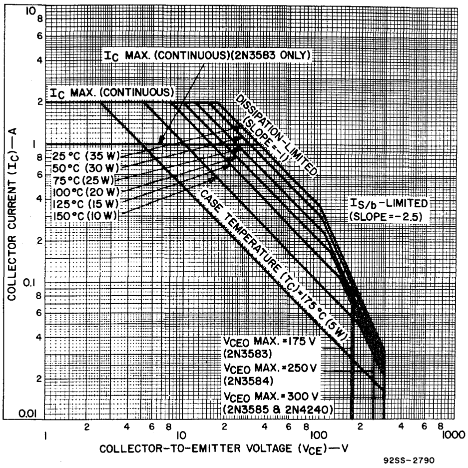


Fig.8—Maximum operating areas for 2N3583, 2N3584, 2N3585, and 2N4240 (pulse conditions).

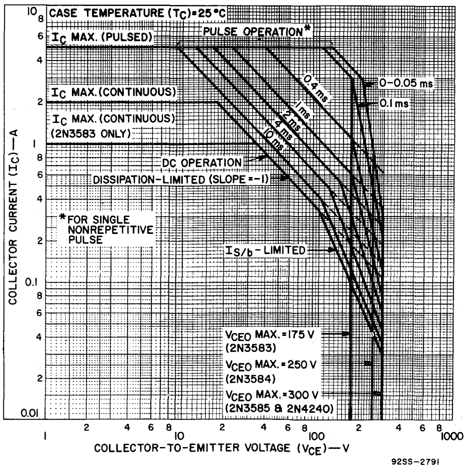


Fig.9—Maximum operating areas for 2N3583, 2N3584, 2N3585, and 2N4240 (dc conditions).

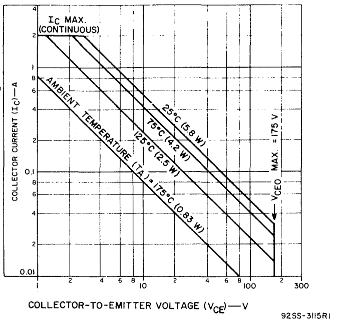


Fig.10—Maximum operating areas for 40374.

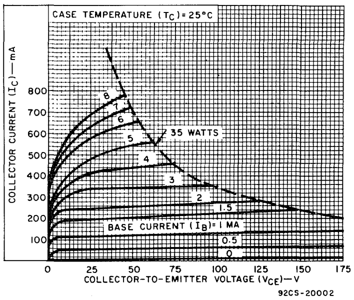


Fig.11—Typical output characteristics for 2N3583 and 40374.

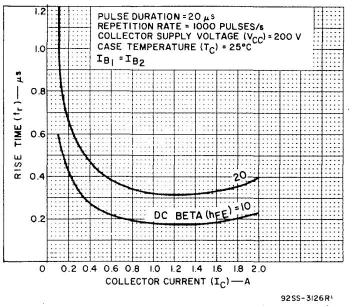


Fig.12—Typical rise time vs. collector current for 2N3584 and 2N3585.

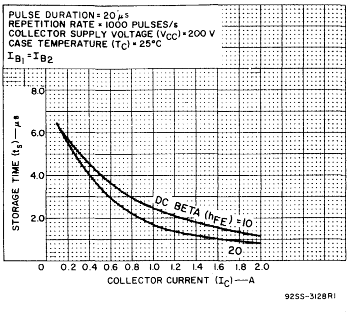


Fig.13—Typical storage time vs. collector current for 2N3584 and 2N3585.

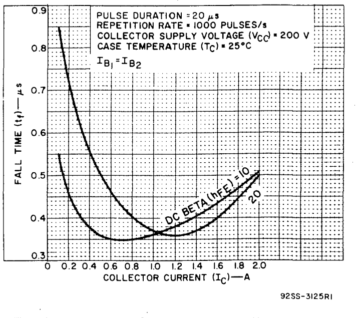


Fig.14—Typical fall time vs. collector current for 2N3584 and 2N3585.

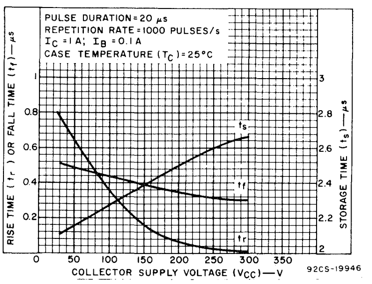


Fig.15—Typical rise time, fall time, and storage time vs. collector supply voltage for 2N3584 and 2N3585.

2N3771, 2N3772, 2N6257, RCS258

Hometaxial-Base High-Power High-Current Transistors

Rugged Silicon N-P-N Devices for Applications in Industrial and Commercial Equipment

These RCA types are hometaxial base, silicon n-p-n transistors intended for a wide variety of high-power, high-current applications. Typical applications for these transistors include power-switching circuits, audio amplifiers, series- and shunt-regulator driver and output stages, dc-to-dc converters, inverters, and solenoid (hammer)/relay driver service.

All devices employ the popular JEDEC TO-3 package; they differ in maximum ratings for voltage, current, and power.

Features:

- **High dissipation capability**
- **$V_{CEX}(sus)$ at 3 A = 50 V min. (2N3771, 2N6257) = 90 V min. (2N3772)**
- **15-A specification for: h_{FE}, V_{BE}, & $V_{CE}(sat)$ (2N3771, 2N6257)**
- **10-A specification for: h_{FE}, V_{BE}, & $V_{CE}(sat)$ (2N3772, RCS258)**
- **Low saturation voltage with high beta**

MAXIMUM RATINGS, *Absolute-Maximum Values:*		**2N3771**	**2N3772**	**2N6257**	**RCS258**	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	50	100	50	100	V
*COLLECTOR-TO-EMITTER VOLTAGE:						
With −1.5 V (V_{BE}) & R_{BE} = 100Ω	V_{CEX}	50	80	50	80	V
With base open.	V_{CEO}	40	60	40	60	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	7	5	7	V
*CONTINUOUS COLLECTOR CURRENT	I_C	30	20	20	20	A
*PEAK COLLECTOR CURRENT	I_{CM}	30	30	30	30	A
*CONTINUOUS BASE CURRENT	I_B	7.5	5	5	5	A
*PEAK BASE CURRENT	I_{BM}	15	15	15	15	A
*TRANSISTOR DISSIPATION:	P_T					
At case temperatures up to 25°C		150	150	150	250	W
At case temperatures above 25°C		Derate linearly to 200°C				
*TEMPERATURE RANGE:						
Storage & Operating (Junction)		−65 to 200				°C
*PIN TEMPERATURE (During soldering):						
At distance ⩾ 1/32 in. (0.8 mm) from seating plane for 10 s max.		230				

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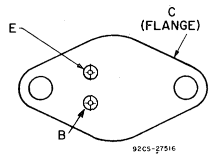
*In accordance with JEDEC registration data format JS-6 RDF-2.

TERMINAL DESIGNATIONS



JEDEC TO-3

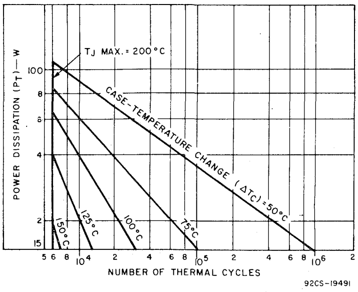


Fig.1—Thermal-cycle rating chart for 2N3771, 2N3772, and 2N6257.

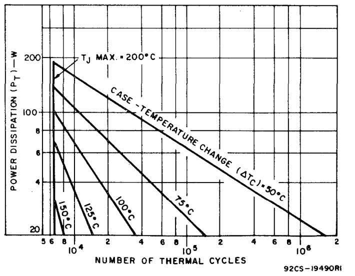


Fig. 2 — Thermal-cycle rating chart for RCS258.

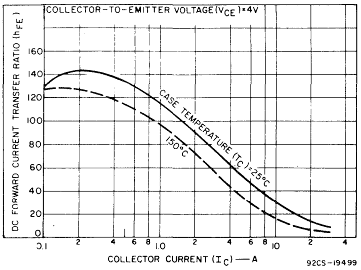


Fig.3—Typical dc beta characteristics for 2N3771.

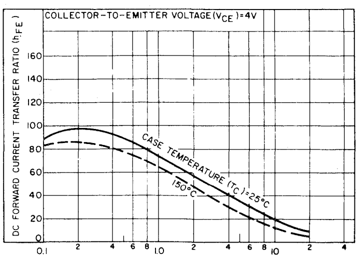


Fig. 4 — Typical dc beta characteristics for 2N3772, 2N6257 and RCS258.

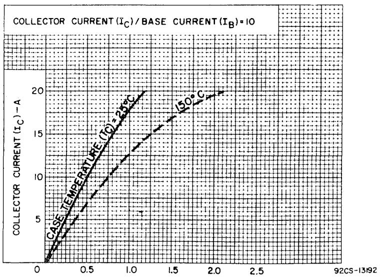


Fig.5—Typical saturation-voltage characteristics for 2N3771.

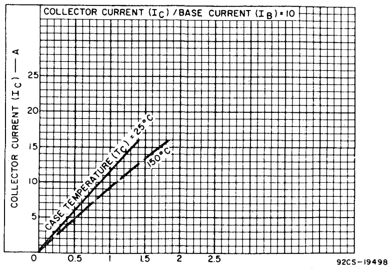


Fig. 6 — Typical saturation-voltage characteristics for 2N3772, 2N6257 and RCS258.

2N3771, 2N3772, 2N6257, RCS258

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25° Unless Otherwise Specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS					LIMITS								UNITS
		VOLTAGE V dc			CURRENT A dc		2N3771		2N3772		2N6257		RCS258		
		V_{CB}	V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
* Collector-Cutoff Current With emitter open	I_{CBO}	50					–	2*	–	–	–	4	–	–	mA
		100					–	–	–	5*	–	–	–	5	
With base-emitter junction reverse-biased	I_{CEX}		45	−1.5			–	–	–	–	–	4	–	–	mA
			50	−1.5			–	2	–	–	–	–	–	–	
			100	−1.5			–	–	–	5	–	–	–	5	
With base-emitter junction reversed-biased, T_C=150°C	I_{CEX}		30	−1.5			–	10	–	10	–	–	–	–	mA
			45	−1.5			–	–	–	–	–	20	–	–	
			30	−1.5			–	–	–	–	–	–	–	10	
With base open	I_{CEO}		25			0	–	–	–	–	–	10	–	–	mA
			30			0	–	10	–	–	–	–	–	–	
			50			0	–	–	–	10	–	–	–	10	
* Emitter-Cutoff Current	I_{EBO}			−5	0		–	5	–	–	–	10	–	–	mA
				−7	0		–	–	–	5	–	–	–	5	
* DC Forward Current Transfer Ratio	h_{FE}		4		30[a]		5	–	–	–	–	–	–	–	
			4		20[a]		–	–	5	–	5	–	5	–	
			4		15[a]		15	60	–	–	–	–	–	–	
			4		10[a]		–	–	15	60	–	–	15	60	
			4		8[a]		–	–	–	–	15	75	–	–	
Collector-to-Emitter Sustaining Voltage With base-emitter Junction reversed-biased (R_{BE} = 100Ω)	V_{CEX}(sus)			−1.5	0.2[a]		50	–	80	–	50	–	80	–	V
With external base-to-emitter resistance (R_{BE}) = 100Ω	V_{CER}(sus)				0.2[a]		45	–	70	–	45	–	70	–	V
* With base open	V_{CEO}(sus)				0.2[a]	0	40	–	60	–	40	–	60	–	V
* Base-to-Emitter Voltage	V_{BE}		4		15[a]		–	2.7	–	–	–	–	–	–	V
			4		10[a]		–	–	–	2.2	–	–	–	2.2	
			4		8[a]		–	–	–	–	–	2.2	–	–	
* Collector-to-Emitter Saturation Voltage	V_{CE}(sat)				30[a]	6	–	4	–	–	–	–	–	–	V
					20[a]	4	–	–	–	4	–	4	–	4	
					15[a]	1.5	–	2	–	–	–	–	–	–	
					10[a]	1	–	–	–	1.4	–	–	–	1.4	
					8[a]	0.8	–	–	–	–	–	1.5	–	–	
Second-Breakdown Collector Current With base forward-biased and 1–s nonrepetitive pulse	$I_{S/b}$[b]		60				–	–	2.5	–	–	–	4.2	–	A
			40				3.75	–	–	–	3.75	–	–	–	
Second-Breakdown Energy With base reverse biased and L=40mH, R_{BE}=100Ω	$E_{S/b}$[c]			−1.5	5		500	–	500	–	500	–	500	–	mJ
* Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio (f = 0.05 MHz)	$\|h_{fe}\|$		4		1		4*	16 (Typ)	4*	16 (Typ)	4*	16 (Typ)	4	16 (Typ)	
* Common-Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio (f = 1 kHz)	h_{fe}		4		1		40	–	40	–	40	–	40	–	
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$						–	1.17	–	1.17	–	1.17	–	0.7	°C/W

* In accordance with JEDEC registration data formal JS-6 RDF-2.

[a] Pulsed; pulse duration = 300 μs, rep. rate = 60 Hz, duty factor ⩽ 2%.

[b] $I_{S/b}$ is defined at the current at which second breakdown occurs at a specified collector voltage with the emitter-base junction forward biased for transistor operation in the active region.

[c] $E_{S/b}$ is defined as the energy at which second breakdown occurs under specified reverse-bias conditions. $E_{S/b} = ½LI^2$, where L is a series load or leakage inductance and I is the peak collector current.

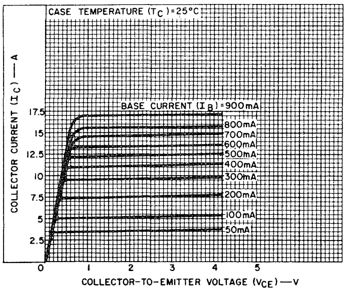


Fig.7—Typical output characteristics for 2N3771.

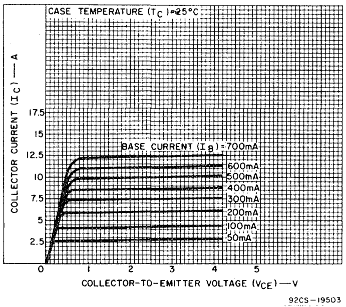


Fig. 8 — Typical output characteristics for 2N3772, 2N6257 and RCS258.

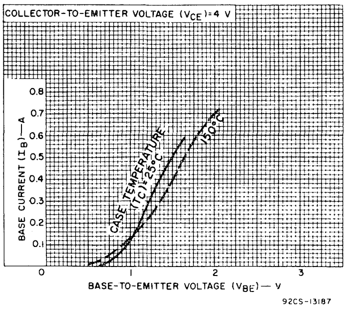


Fig. 9 — Typical input characteristics for 2N3772 and RCS258.

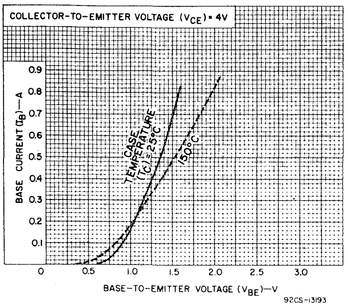


Fig.10—Typical input characteristics for 2N3771 and 2N6257.

2N3771, 2N3772,2N6257, RCS258

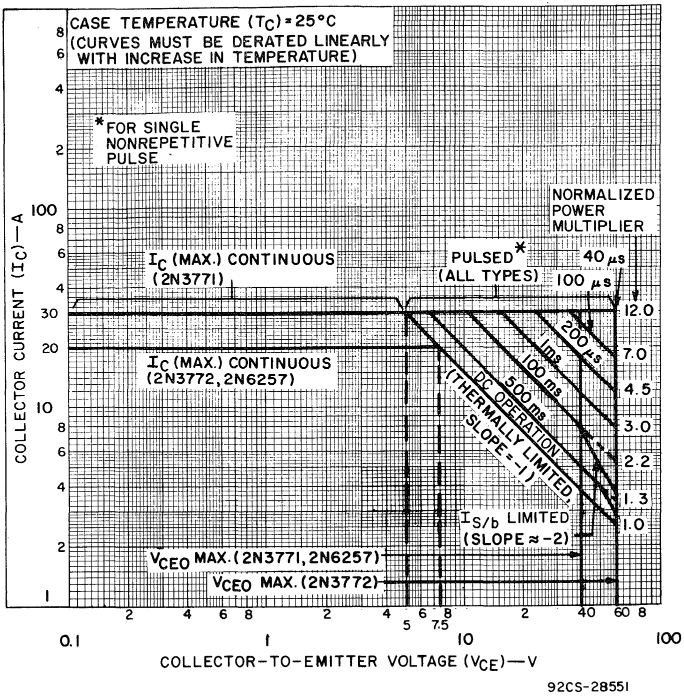


Fig.11—Maximum operating areas for 2N3771, 2N3772, and 2N6257.

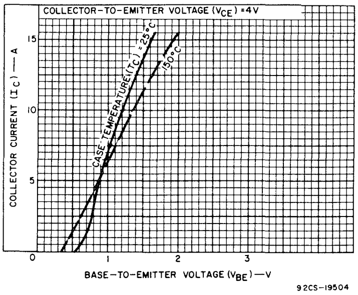


Fig.13—Typical transfer characteristics for 2N3771.

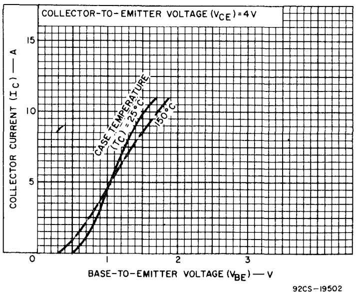


Fig. 14 — Typical transfer characteristics for 2N3772, 2N6257 and RCS258.

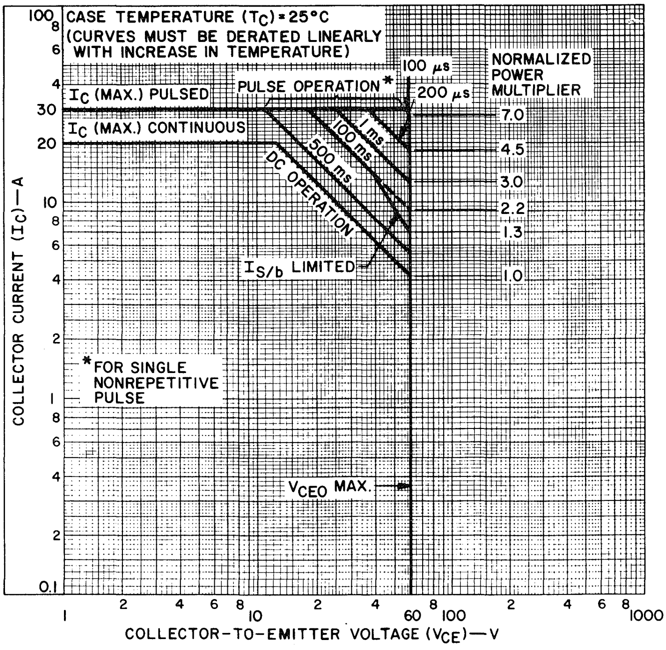


Fig.12—Maximum operating areas for RCS258.

2N3773, 2N4348, 2N6259

Hometaxial-Base, High-Current Silicon N-P-N Transistors

Rugged High-Voltage Devices for Applications in Industrial and Commercial Equipment

These RCA types are hometaxial-base silicon n-p-n transistors intended for a wide variety of high-voltage high-current applications. Typical applications for these transistors include power-switching circuits, audio amplifiers, series- and shunt-regulator driver and output stages, dc-to-dc converters, inverters, and solenoid (hammer)/relay driver service.

These devices employ the popular JEDEC TO-3 package; they differ in maximum ratings for voltage, current, and power.

Features:

- **High dissipation capability –**
  120 W (2N4348), 150 W (2N3773), 250 W (2N6259)
- **5-A specification for h_{FE}, V_{BE}, & V_{CE}(sat) (2N4348)**
- **8-A specification for**
  h_{FE}, V_{BE}, & V_{CE}(sat) (2N3773, 2N6259)
- **V_{CEX} –**
  140 V min (2N4348), 160 V min (2N3773)
  170 V min (2N6259)
- **Low saturation voltage with high beta**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		2N4348	2N3773	2N6259	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	140	160	170	V
COLLECTOR-TO-EMITTER VOLTAGE:					
* With base open	V_{CEO}	120	140	150	V
With reverse bias (V_{BE}) of −1.5 V	V_{CEX}	140	160	170	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	7	7	V
*COLLECTOR CURRENT:	I_C				
Continuous		10	16	16	A
Peak		30	30	30	A
*BASE CURRENT:	I_B				
Continuous		4	4	4	A
Peak		15	15	15	A
*TRANSISTOR DISSIPATION:	P_T				
At case temperatures up to 25°C		120	150	250	W
At case temperatures above 25°C		Derate linearly to 200°C			
*TEMPERATURE RANGE:					
Storage & Operating (Junction)		← −65 to +200 →			°C
*PIN TEMPERATURE (During Soldering):					
At distances ≥ 1/32 in. (0.8 mm) from case for 10 s max.		← 230 →			°C

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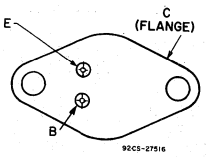
* In accordance with JEDEC registration data format (JS-6, RDF-2).

TERMINAL DESIGNATIONS



JEDEC TO-3

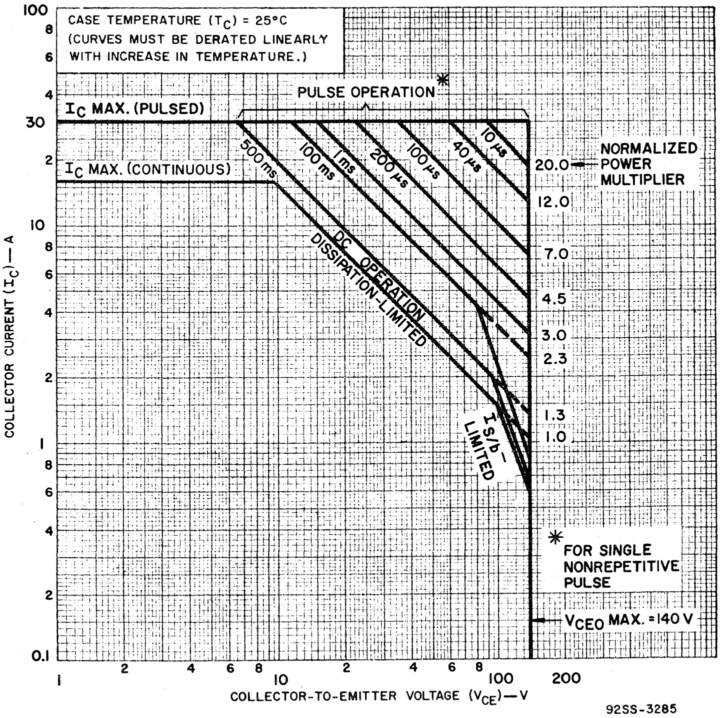


Fig. 1 - Maximum operating areas for 2N3773.

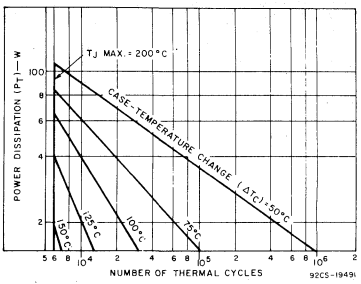


Fig. 2 - Thermal-cycle rating chart for 2N3773.

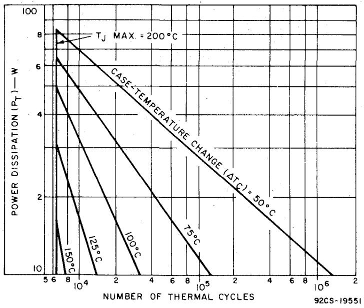


Fig. 3 - Thermal-cycle rating chart for 2N4348.

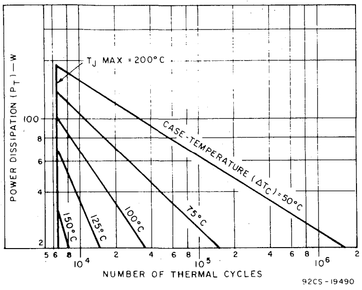


Fig. 4 - Thermal-cycle rating chart for 2N6259.

2N3773, 2N4348, 2N6259

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS						UNITS
		VOLTAGE V dc		CURRENT A dc		2N4348		2N3773		2N6259		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
* Collector-Cutoff Current: With emitter open, V_{CB}=140 V	I_{CBO}					–	–	–	2	–	–	mA
With base-emitter junction reverse-biased	I_{CEX}	120 140 150	−1.5 −1.5 −1.5			– – –	2 – –	– – –	– 2 –	– – –	– – 0.2	mA
With base-emitter junction reverse-biased and T_C = 150°C	I_{CEX}	120 140 150	−1.5 −1.5 −1.5			– – –	10 – –	– – –	– 10 –	– – –	– – 4	mA
With base open	I_{CEO}	100 120				– –	20 –	– –	– 10	– –	– 2	mA
* Emitter-Cutoff Current	I_{EBO}		−7	0		–	5	–	5	–	2	mA
* DC Forward Current Transfer Ratio	h_{FE}	4 4 2 4 4		5^a 8^a 8^a 10^a 16^a		15 – – 10 –	60 – – – –	– 15 – – 5	– 60 – – –	– – 15 – 10	– – 60 – –	
Collector-to-Emitter Sustaining Voltage: With base-emitter junction reverse-biased (R_{BE} = 100Ω)	V_{CEX}(sus)		−1.5	0.1		140		160	–	170		V
With external base-to-emitter resistance (R_{BE}) = 100Ω	V_{CER}(sus)			0.2^a		140	–	150	–	160	–	V
* With base open	V_{CEO}(sus)			0.2^a	0	120	–	140		150	–	V
* Base-to-Emitter Voltage	V_{BE}	4 4 2 4		5^a 8^a 8^a 10^a		– – –	2 – – 3	– – 	 2.2 – –	– – – –	– – 2 –	V
* Collector-to-Emitter Saturation Voltage	V_{CE}(sat)			5^a 8^a 10^a 16^a	0.5 0.8 1.25 3.2	 – 	1 – 2 –	– – – –	– 1.4 – 4	– – –	– 1 – 2.5	V
Second-Breakdown Collector Current With base forward-biased and 1-s nonrepetitive pulse	$I_{S/b}$[b]	80 100				1.5 –	– –	– 1.5	– –	 2.5	– –	A
Second-Breakdown Energy With base reverse-biased and L = 40 mH, R_{BE} = 100Ω	$E_{S/b}$[c]		−1.5	2.5		0.125	–	0.125	–	0.125	–	J
* Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio (f = 50 kHz)	$\|h_{fe}\|$	4		1		4	–	4	–	4	–	
* Common-Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio (f = 1 kHz)	h_{fe}	4		1		40	–	40	–	40	–	
Thermal Resistance Junction-to-Case	$R_{\theta JC}$					–	1.46	–	1.17	–	0.7	°C/W

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* In accordance with JEDEC registration data format JS 6 RDF-2.

[a] Pulsed; pulse duration = 300μs, rep. rate = 60 Hz.

[b] $I_{S/b}$ is defined as the current at which second breakdown occurs at a specified collector voltage with the emitter base junction forward-biased for transistor operation in the active region.

[c] $E_{S/b}$ is defined as the energy at which second breakdown occurs under specified reverse-bias conditions. $E_{S/b}$ 1/2LI^2 where L is a series load or leakage inductance and I is the peak collector current.

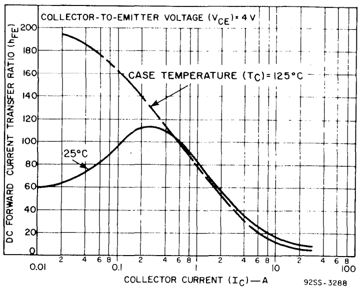


Fig. 5 - Typical dc beta characteristics for 2N3773.

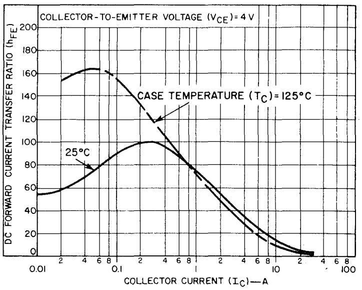


Fig. 6 - Typical dc beta characteristics for 2N4348.

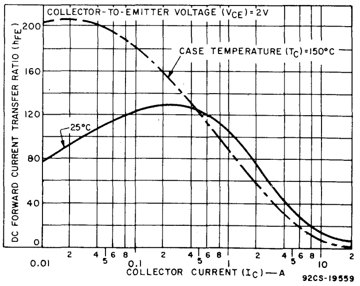


Fig. 7 - Typical dc beta characteristics for 2N6259.

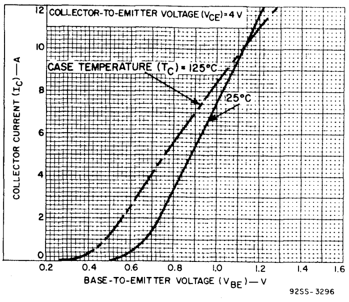


Fig. 8 - Typical transfer characteristics for 2N3773.

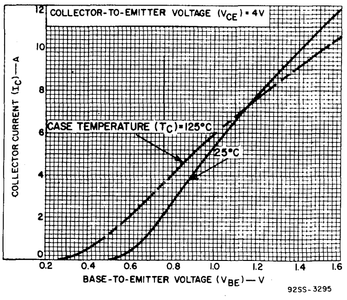


Fig. 9 - Typical transfer characteristics for 2N4348.

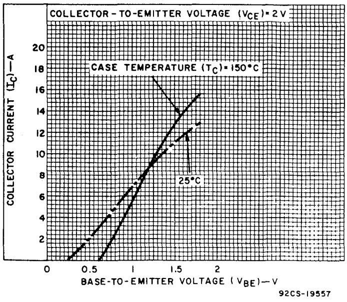


Fig. 10 - Typical transfer characteristics for 2N6259.

2N3773, 2N4348, 2N6259

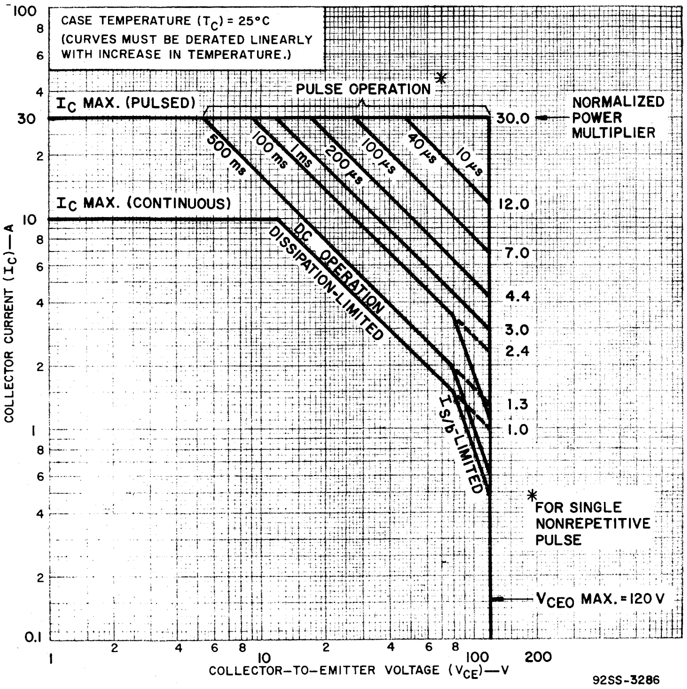


Fig. 11 - Maximum operating areas for 2N4348.

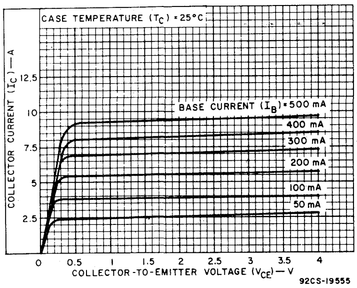


Fig. 12 - Typical output characteristics for 2N3773.

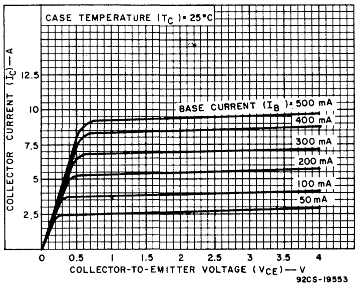


Fig. 13 - Typical output characteristics for 2N4348.

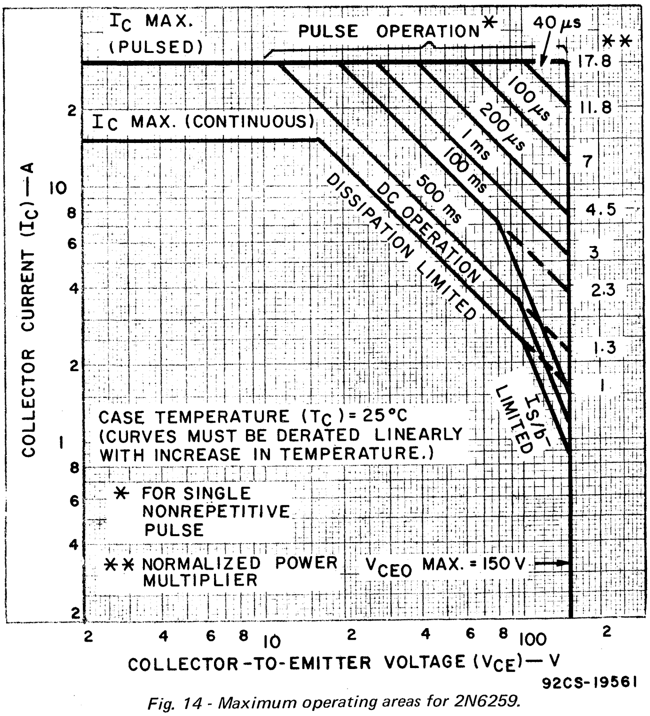


Fig. 14 - Maximum operating areas for 2N6259.

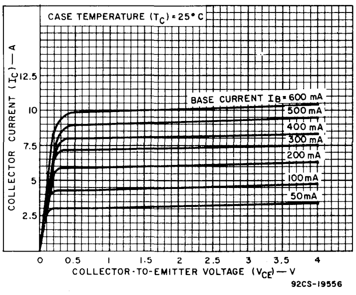


Fig. 15 - Typical output characteristics for 2N6259.

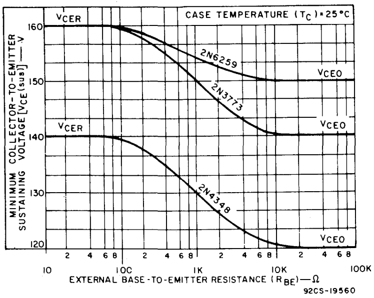


Fig. 16 - Sustaining voltage as a function of base-to-emitter resistance for all types.

2N3773, 2N4348, 2N6259

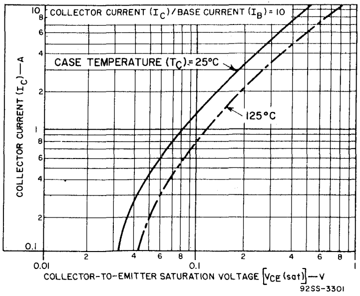


Fig. 17 - Typical saturation-voltage characteristics for 2N3773.

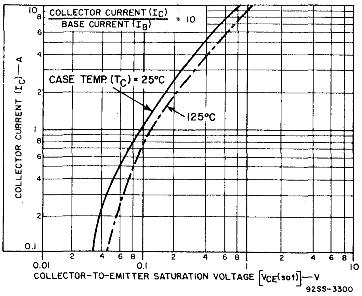


Fig. 18 - Typical saturation-voltage characteristics for 2N4348.

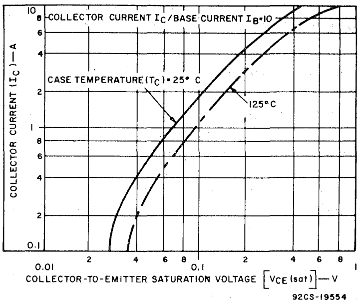


Fig. 19 - Typical saturation-voltage characteristics for 2N6259.

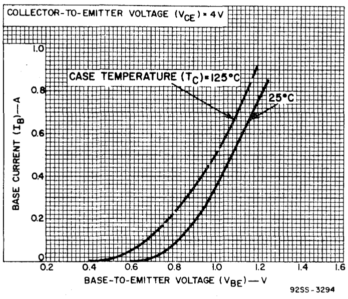


Fig. 20 - Typical input characteristics for 2N3773.

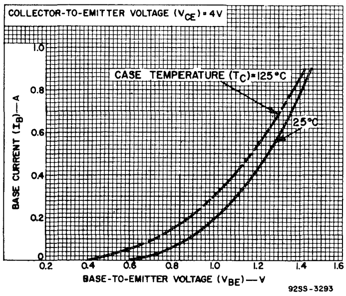


Fig. 21 - Typical input characteristics for 2N4348.

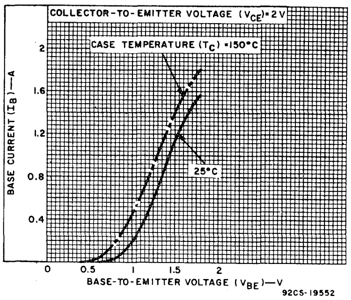


Fig. 22 - Typical input characteristics for 2N6259.

2N3878, 2N3879, 2N5202, 2N6500, 40375

High-Speed, Epitaxial-Collector Silicon N-P-N Transistors

For High-Speed Switching and Linear-Amplifier Applications

Features:

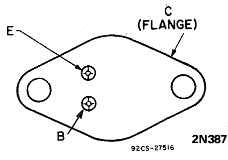
- Maximum-area-of-operation curves for dc and pulse operation
- Rated for safe operation in both forward- and reverse-bias conditions
- High sustaining voltage
- Total saturated transition time less than 1 μs for 2N3879, 2N5202, and 2N6500

RCA-2N3878, 2N3879, 2N5202, and 2N6500● are epitaxial silicon n-p-n transistors. The 2N3878 is an amplifier type intended for audio-, ultrasonic-, and radio-frequency circuits. Types 2N3879, 2N5202, and 2N6500 are switching transistors intended for use in high-current, high-speed switching circuits. Type 40375 is a 2N3878 with a factory-attached heat radiator; it is intended for printed circuit-board applications.

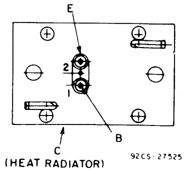
Typical applications for these transistors include: low-distortion power amplifiers, oscillators, switching regulators, series regulators, converters, and inverters.

● Formerly RCA Dev. Type Nos. TA2509, TA2509A, TA7285, and TA8932, respectively.

TERMINAL DESIGNATIONS



JEDEC TO-66
2N3878, 2N3879, 2N5202, 2N6500



JEDEC TO-66 with Heat Radiator
40375

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		2N3878 40375	2N3879	2N5202	2N6500	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	120	120	100	120	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:						
With external base-to-emitter resistance (R_{BE}) = 50 Ω.	V_{CER}(sus)	65	90	75*	110*	V
With base open	V_{CEO}(sus)	50*	75*	50	90*	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	7	6	7	V
*CONTINUOUS COLLECTOR CURRENT	I_C	4	7	4	4	A
PEAK COLLECTOR CURRENT	I_{CM}	10	10	5	5	A
*CONTINUOUS BASE CURRENT	I_B	4	5	2	3	A
*TRANSISTOR DISSIPATION	P_T					
At case temperature (T_C) = 25°C		35 (2N3878)	35	35	35	W
At case temperatures above 25°C		Derate linearly at 0.2 W/°C				
At ambient temperature (T_A) = 25°C		5.8 (40375)	–	–	–	W
For other conditions		See Figs. 1, 2, 3, and 9				
*TEMPERATURE RANGE:						
Storage & operating (Junction)		-65 to 200				°C
*PIN TEMPERATURE:						
1/32 in. (0.8 mm) from seating plane for 10 s max.		235	235	235	235	°C

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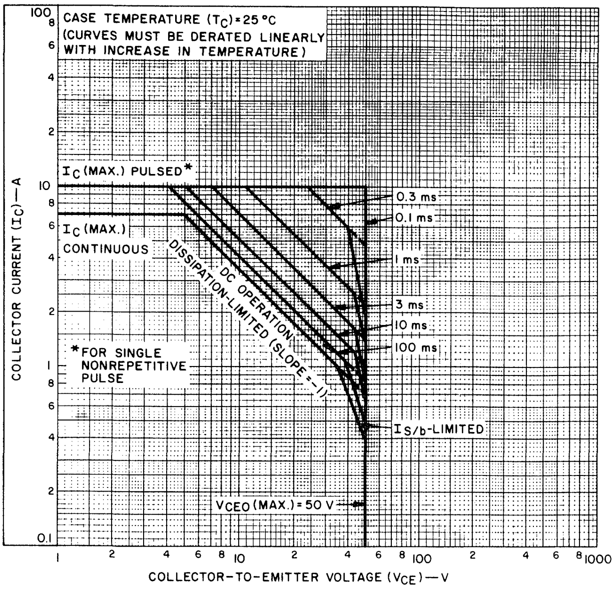
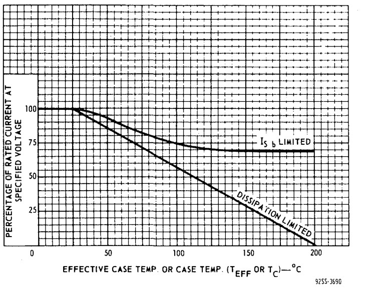
* In accordance with JEDEC registration data format JS-6 RDF-2 (2N3878); JS-6 RDF-1 (2N3879, 2N5202, 2N6500).



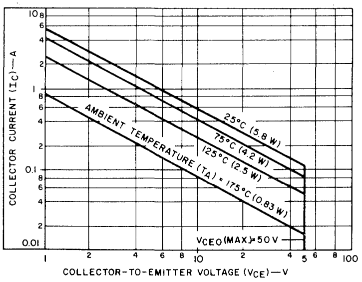
92CS-23755

Fig. 1 - Maximum operating areas for 2N3878.



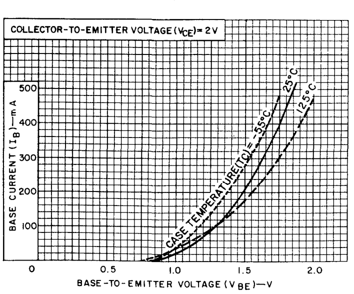
Note: Use ambient temperature for derating 40375.

Fig. 2 - Dissipation derating for all types.



92SS-2777R2

Fig. 3 - Maximum operating areas for 40375.



92CS-13227

Fig. 4 - Typical input characteristics for all types.

2N3878, 2N3879, 2N5202, 2N6500, 40375

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified:*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS								UNITS
		VOLTAGE V dc		CURRENT A dc		2N3878 40375		2N3879		2N5202		2N6500		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Collector Cutoff Current: * With base-emitter junction reverse-biased	I_{CEV}	100 110 120	−1.5 0 −1.5			– – –	– – 25	– – –	– – 25	– – –	10 – –	– – –	– 5 –	mA
* With base-emitter junction reverse-biased and T_C = 150°C		100 110	−1.5 0			– –	4 –	– –	4 –	– –	10 –	– –	– 10	
With base open	I_{CEO}	40 70			0 0	– –	5* –	– –	5 –	– –	– –	– –	– 5	mA
* Emitter Cutoff Current	I_{EBO}		−6 −7			– –	– 10	– –	– 10	– –	10 –	– –	– 25	mA
Collector-to-Emitter Sustaining Voltage With base open	V_{CEO}(sus)			0.2	0	50*a	–	75*a	–	50a	–	90*a	–	V
With external base-to-emitter resistance (R_{BE}) = 50 Ω	V_{CER}(sus)			0.2	0	65a	–	90a	–	75a	–	110a		
DC Forward-Current Transfer Ratio	h_{FE}	1.2		4b		–	–	–	–	10*	100*	–	–	
		2		0.5b		40*	200*	–	–	–		–	–	
		2		3b		–	–	–	–	–		15*	60*	
		2		4b		8*	–	12*	100*	–	–		–	
		5		4b		20*		20	80	–	–	–		
		5		0.5b		50*	200*	40	–		–			
* Collector-to-Emitter Saturation Voltage	V_{CE}(sat)			3b 4b	0.3 0.4		 2		 1.2	 –	 1.2	 –	1.5 –	V
* Base-to-Emitter Voltage	V_{BE}	2		4b			2.5							V
* Base-to-Emitter Saturation Voltage	V_{BE}(sat)			3b 4b	0.3 0.4				 2		 2		2.5	V
Collector-to-Base Output Capacitance : (f = 1 MHz, V_{CB} = 10 V)	C_{ob}						175*		175		175		175	pF
Second Breakdown Collector Current: With base forward-biased and 1-s nonrepetitive pulse	$I_{S/b}$	40				750		500		400		400		mA
Second-Breakdown Energy: With base reverse-biased and R_{BE} = 50 Ω, V_{BB} = −4 V At L = 50 µH At L = 125 µH	$E_{S/b}$[c]					 1		 1		0.4 		 0.5		mJ
* Magnitude of Common Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio:(f = 10 MHz)	$\|h_{fe}\|$	10		0.5		4		4		6		6		
* Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio:(f = 1 kHz)	h_{fe}	30		0.1		40								
Thermal Resistance: Junction-to-case	$R_{\theta JC}$					2N3878 –	5	–	5	–	5	–	5	°C/W
Junction-to-ambient	$R_{\theta JA}$					40375 –	30	–	–	–	–	–	–	

* In accordance with JEDEC registration data format JS-6 RDF-2 (2N3878); JS-6 RDF-1 (2N3879, 2N5202, 2N6500).

[a] CAUTION: Sustaining voltages V_{CEO}(sus) and V_{CER}(sus) MUST NOT be measured on a curve tracer.

[b] Pulsed, pulse duration = 300 µs, duty factor ⩽ 2 %.

[c] $E_{S/b}$ is defined as the energy at which second breakdown occurs under specified reverse-bias conditions. $E_{S/b} = 1/2LI^2$ where L is a series load or leakage inductance and I is the peak collector current.

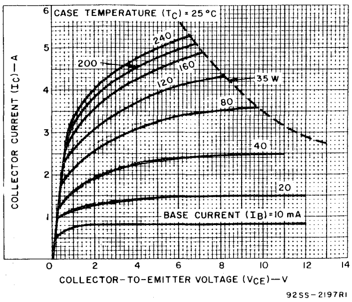


Fig. 5 - Typical output characteristics for 2N3878, 2N3879, 2N5202 and 40375.

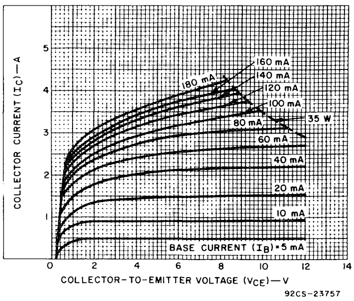


Fig. 6 - Typical output characteristics for 2N6500.

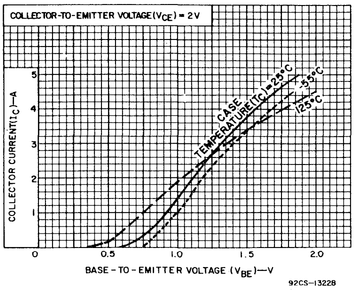


Fig. 7 - Typical transfer characteristics for all types.

TRANSITION AND STORAGE-TIME CHARACTERISTICS FOR SWITCHING TYPES, *At Case Temperature (T_C) = 25°C:*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS			LIMITS						UNITS
		VOLTAGE V dc	CURRENT A dc		2N3879		2N5202		2N6500		
		V_{CC}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
Saturated Switching Time Delay time	t_d	30 30 30	3 4 4	0.3a 0.4a 0.8a	– – –	– 40 –	– – –	– – 40	– – –	40 – –	ns
* Rise time	t_r	30 30 30	3 4 4	0.3a 0.4a 0.8a	– – –	– 400 –	– – –	– – 400	– – –	400 – –	
* Storage time	t_s	30 30 30	3 4 4	0.3a 0.4a 0.8a	– – –	– 800 –	– – –	– – 1200	– – –	1000 – –	
* Fall time	t_f	30 30 30	3 4 4	0.3a 0.4a 0.8a	– – –	– 400 –	– – –	– – 400	– – –	500 – –	

* In accordance with JEDEC registration data format (JS-6, RDF-1)

[a] $I_{B_1} = I_{B_2}$

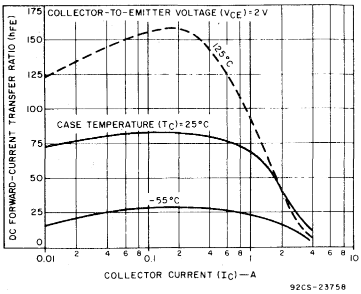


Fig. 8 - Typical dc beta characteristics for 2N6500.

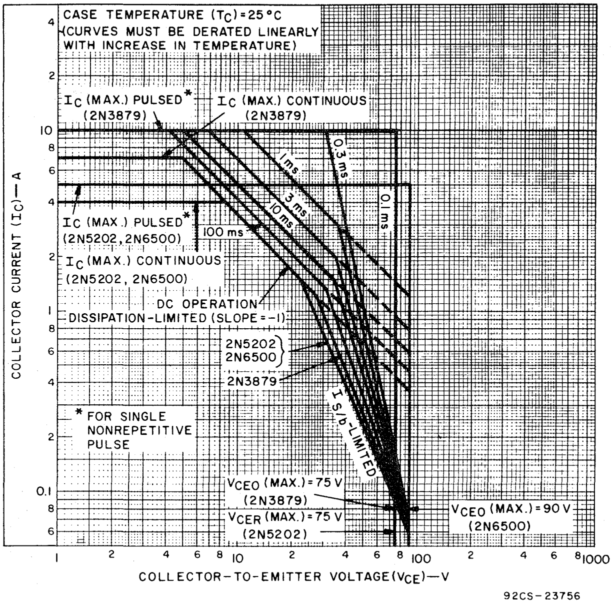


Fig. 9 - Maximum operating areas for 2N3879, 2N5202, and 2N6500.

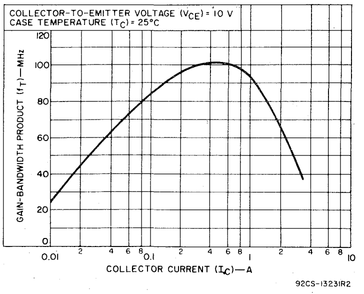


Fig. 10 - Typical gain-bandwidth product for all types.

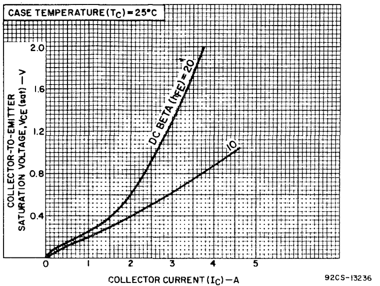


Fig. 11 - Typical saturation-voltage characteristics for 2N3878, and 2N3879.

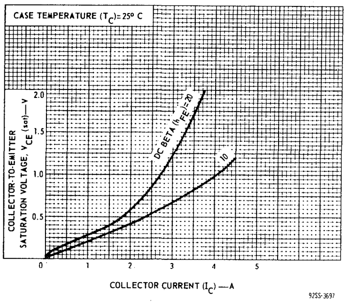


Fig. 12 - Typical saturation-voltage characteristics for 2N5202.

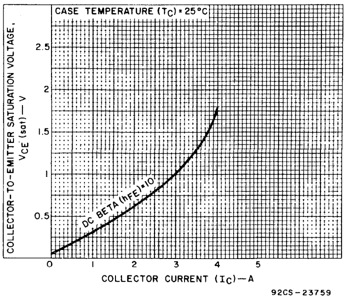


Fig. 13 - Typical saturation-voltage characteristics for 2N6500.

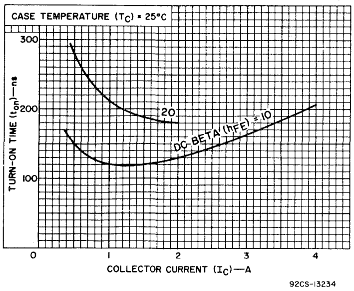


Fig. 14 - Typical turn-on time for 2N3879, 2N5202, and 2N6500.

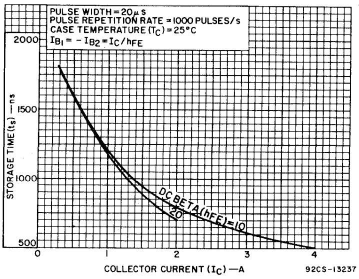


Fig. 15 - Typical storage time for 2N3879, 2N5202, and 2N6500.

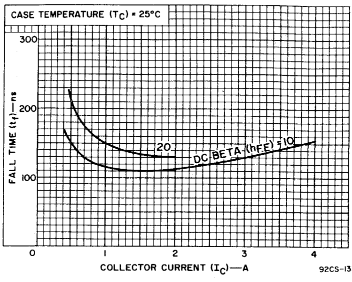


Fig. 16 - Typical fall time for 2N3879, 2N5202, and 2N6500.

2N4036, 2N4037, 2N4314, 40391, 40394, 41503

Medium-Power Silicon P-N-P Planar Transistors

General-Purpose Types for Industrial and Commercial Applications

These RCA types are double-diffused, epitaxial-planar, silicon p-n-p transistors; they differ in breakdown-voltage ratings, leakage-current, and saturation characteristics.

The 2N4036, 2N4037, 2N4314, 40391, and 40394 transistors are intended for a wide variety of small-signal medium-power applications. With a minimum gain-bandwidth product (f_T) of 60 MHz, these devices provide useful gain at high frequencies. In addition, the 2N4036 is useful in high-speed saturated switching applications.

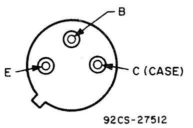
Type 41503 is suitable for low-power, low-cost industrial and audio uses, and may be employed as the p-n-p complement to RCA n-p-n type 41502.

Types 2N4036, 2N4037, 2N4314, and 41503 are supplied in the JEDEC TO-39 hermetic package. The 40391 is a 2N4037 with a factory attached heat radiator, intended for printed-circuit-board applications. Type 40394 is a 2N4037 with a factory-attached diamond-shaped mounting flange.

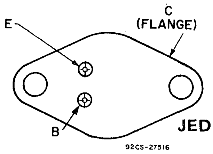
Features:

- **2N4036 } are p-n-p { 2N2102**
  2N4037 } complements of { 2N3053
- **Gain-bandwidth product (f_T) = 60 MHz min.**
- **High breakdown voltages**
- **Maximum-area-of-operation curves**
- **Planar construction provides low noise and low leakage**
- **Low saturation voltages**
- **High pulsed beta at high collector current**
- **Fast switching (2N4036)**

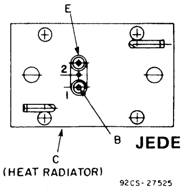
TERMINAL DESIGNATIONS



JEDEC TO-39
2N4036, 2N4037
2N4314, 41503



JEDEC TO-39 with Flange
40394



JEDEC TO-39 with Heat Radiator
40391

MAXIMUM RATINGS, *Absolute Maximum Values:*		2N4036	2N4037 40391, 40394	2N4314	41503	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	−90	−60	−90	–	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:						
With 1.5 volts (V_{BE}) of reverse bias	V_{CEV}(sus)	−85	−60	−85	–	V
With external base-to-emitter resistance (R_{BE}) ⩽ 200Ω	V_{CER}(sus)	−85	−60	−85	–	V
* With base open	V_{CEO}(sus)	−65	−40	−65	−30	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	−7	−7	−7	−4	V
*COLLECTOR CURRENT	I_C	−1.0	−1.0	−1.0	−1	A
*BASE CURRENT	I_B	−0.5	−0.5	−0.5	−0.5	
*TRANSISTOR DISSIPATION:	P_T					
At case temperatures up to 25°C		7	7(2N4037)	7	7	W
		–	7(40394)	–	–	W
At free-air temperatures up to 25°C		1	3.5(40391)	1	1	W
		–	1(2N4037, 40394)	–	–	W
At temperatures above 25°C		Derate linearly to 200°C				
*TEMPERATURE RANGE:						
Storage & Operating (Junction)		−65 to 200				°C
*LEAD TEMPERATURE (During soldering):						
At distance ⩾ 1/16 in. (1.58 mm) from seating plane for 10 s max.		230				°C

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* *In accordance with JEDEC registration data format (JS-6 RDF-1 2N4036; JS-9 RDF-2 2N4037, 2N4314).*

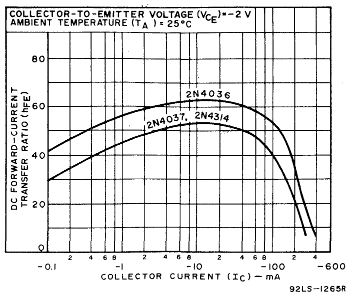

Fig.1—Typical dc-beta characteristics for 2N4036, 2N4037 and 2N4314.

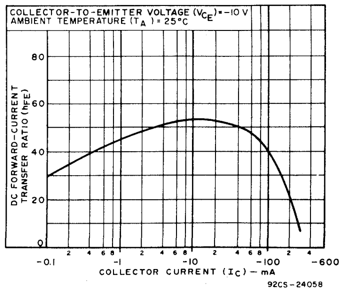

Fig.2—Typical dc-beta characteristic for 41503.

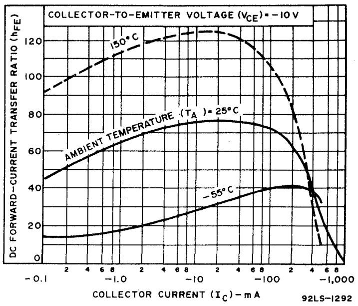

Fig.3—Typical dc beta characteristics for 2N4037 and 2N4314.

2N4036, 2N4037, 2N4314, 40391, 40394, 41503

ELECTRICAL CHARACTERISTICS, *at Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS								UNITS
		VOLTAGE V dc			CUR-RENT mA dc	2N4036		2N4037 40391 40394		2N4314		41503		
		V_{CB}	V_{CE}	V_{BE}	I_C	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
Collector Cutoff Current: With emitter open	I_{CBO}	–15 –90 –60				– – 	– -0.1● -0.02	– – –	– – -0.25●	– – –	– – -0.25●	– – –	–2 – –	μA mA μA
With base open	I_{CEO}		–30			–	-0.5●	–	-5●	–	-5●	–	–	μA
With base-emitter junction reverse biased	I_{CEX}		–85	1.5		–	-100●	–	–	–	–	–	–	mA
T_C = 150°C			–30	1.5		–	-0.1●	–	–	–	–	–	–	
Emitter Cutoff Current	I_{EBO}			7 5	0 0	– –	-0.1● -0.02	– –	– -1●	– –	– -1●	– –	– –	mA μA
Collector-to-Base Breakdown Voltage (I_E = 0)	$V_{(BR)CBO}$				-0.1	-90	–	-60●	–	-90●	–	–	–	V
Emitter-to-Base Breakdown Voltage (I_E = -0.1 mA)	$V_{(BR)EBO}$				0	-7	–	-7	–	-7	–	-4	–	V
Collector-to-Emitter Sustaining Voltage: With base-emitter junction reverse biased	V_{CEV}(sus)			1.5	-100	-85[a]	–	-60[a]	–	-85[a]	–	–	–	V
With external base-to-emitter resistance (R_{BE}) ⩽ 200Ω	V_{CER}(sus)				-100	-85[a]	–	-60[a]	–	-85[a]	–	–	–	V
● With base open	V_{CEO}(sus)				-30 -100	– -65[a]	– –	– -40[a]	– –	– -65[a]	– –	-30[a] –	– –	V
● Collector-to-Emitter Voltage (I_B = -15 mA)	V_{CE}(sat)				-150	–	-0.65	–	-1.4	–	-1.4	–	-1.5	V
Base-to-Emitter Voltage	V_{BE}		-10		-150	–	-1.1	–	-1.5●	–	-1.5●	–	-2.5	V
● Base-to-Emitter Voltage (I_B = -15mA)	V_{BE}(sat)				-150	–	-1.4	–	–	–	–	–	–	V
● DC Forward-Current Transfer Ratio	h_{FE}		-2 -10 -10 -10 -10		-150 -0.1 -1.0 -150[b] -500[b]	20 20 – 40 20	200 – – 140 –	– – 15 50 –	– – – 250 –	– – 15 50 –	– – – 250 –	– – – 20 –	– – – – –	
Common-Emitter, Small-Signal Short-Circuit, Forward-Current Transfer Ratio (at f = 20 MHz)	h_{fe}		-10		-50	3	–	3	–	3	–	–	–	
● Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (at f = 20 MHz)	$\|h_{fe}\|$		-10		-50	3	–	3	10	3	10	–	–	
Collector-Base Capacitance (at f = 1 MHz, I_E = 0)	C_{cb}	-10				–	30	–	30●	–	30●	–	30	pF
Input Capacitance	C_{ib}			0.5	0	–	90	–	90	–	90	–	90	pF
● Sat. Switching Time[c] Rise time Storage time Fall time Turn-on time Turn-off time	 t_r t_s t_f t_{on} t_{off}		 -30 -30 -30 -30 -30		 -150 -150 -150 -150 -150	 – – – – –	 70 600 100 110 700	 – – – – –	 – – – – –	 – – – – –	 – – – – –	 – – – – –	 – – – – –	ηs
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$					– –	25● –	25 (max.) 2N4037 & 40394		– –	25 –	– –	25 –	°C/W
Junction-to-Ambient	$R_{\theta JA}$					– –	165 –	165 (max.) 2N4037 40394 50 (max.) 40391		– –	165 –	– –	165 –	

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[a] CAUTION: The sustaining voltages V_{CEO}(sus), V_{CER}(sus), and V_{CEV}(sus) MUST NOT be measured on a curve tracer.

[b] Pulsed, pulse duration = 300 μs, duty factor ⩽ 2%.

● In accordance with JEDEC registration data format (JS-6 RDF-1 2N4036; JS-9 RDF-2 2N4037, 2N4314).

[c] $I_{B1} = I_{B2}$ = 15 mA

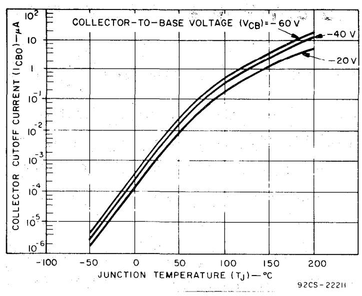

Fig.4—Typical collector-cutoff current vs. junction temperature for 2N4036.

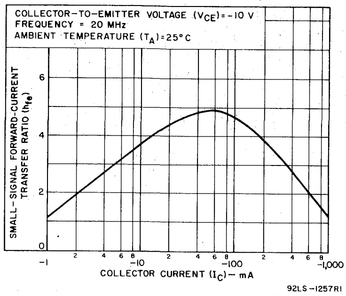

Fig.5—Typical small-signal beta characteristics for all types.

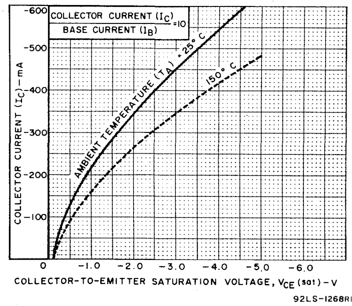

Fig.6—Typical saturation-voltage characteristics for 2N4036.

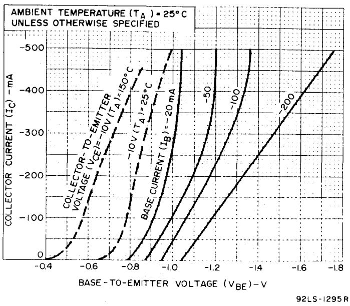

Fig.7—Typical transfer characteristics for 2N4037 and 2N4314.

2N4036, 2N4037, 2N4314, 40391, 40394, 41503

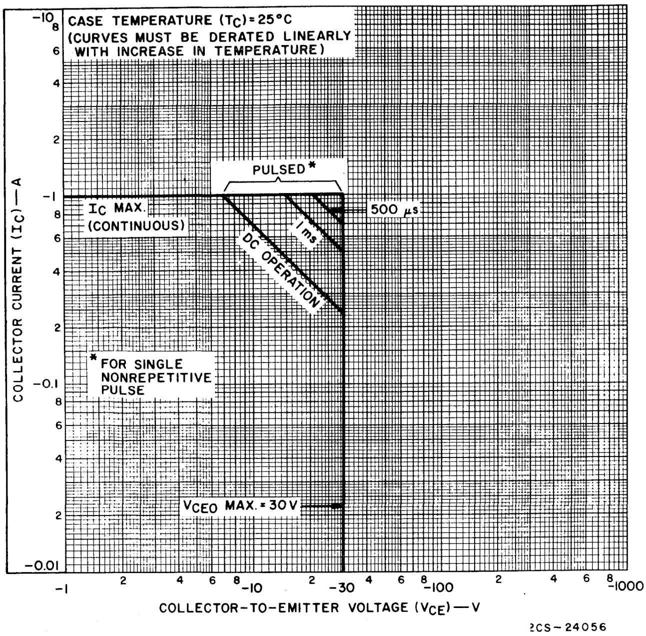

Fig.8—Maximum operating areas for 41503.

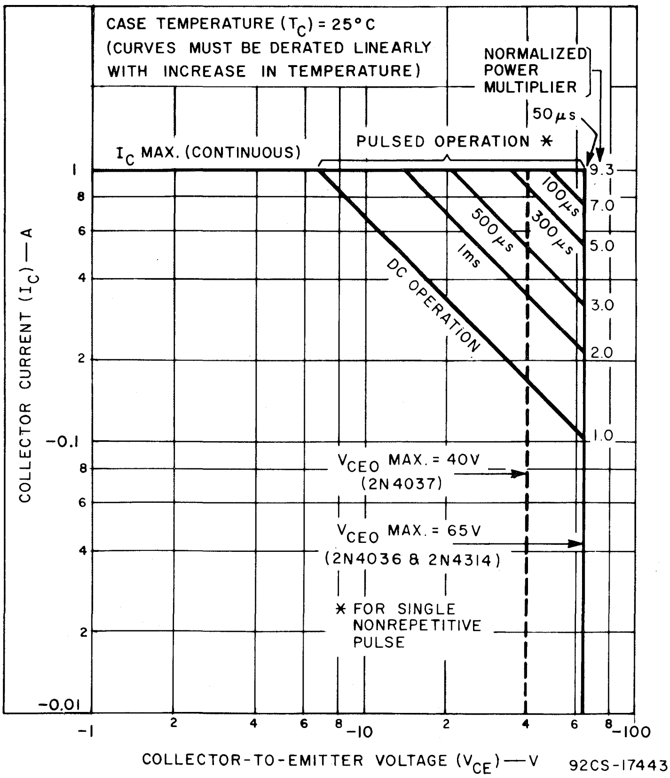

Fig.9—Maximum operating areas for 2N4036, 2N4037, and 2N4314.

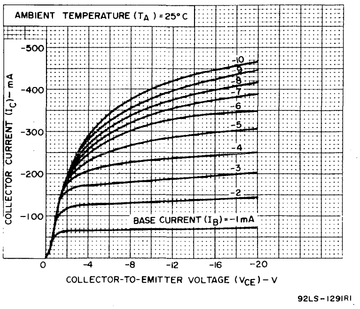

Fig.10—Typical large-signal output characteristics for 2N4037, 2N4314, 40391, and 40394.

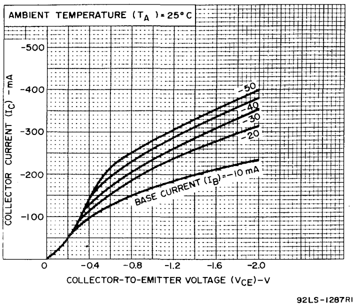

Fig.11—Typical small-signal output characteristics for 2N4037, 2N4314, 40391, and 40394.

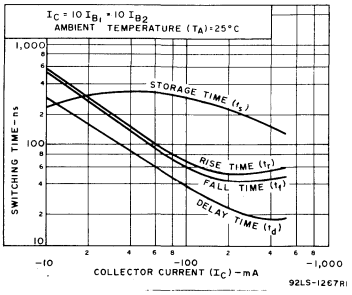

Fig.12—Typical saturated switching times for 2N4036.

2N5038, 2N5039, 2N6354, 2N6496

High-Current, High-Power, High-Speed Silicon N-P-N Power Transistors

Devices for Switching and Amplifier Circuits in Industrial and Commercial Applications

RCA-2N5038, 2N5039, 2N6354, and 2N6496 are epitaxial silicon n-p-n power transistors. They differ in breakdown-voltage ratings, leakage-current, and dc-beta values.

The high current-handling capability of these transistors in conjunction with fast switching speeds make these devices especially sutted for switching-control amplifiers, power gates, switching regulators, converters, and inverters. Other recommended applications include dc-rf amplifiers and power oscillators. These transistors are supplied in the JEDEC TO-3 package.

Features:

- **Maximum operating area curves for dc and pulse operation**
- **$I_{S/b}$-limit line beginning at 28 V**
- **High collector current ratings**
- **High-dissipation capability**
- **Fast switching speeds –**
  Measured at: 5 A, 8 A, 10 A, 12 A levels

MAXIMUM RATINGS, *Absolute Maximum Values:*		**2N5038**	**2N5039**	**2N6354**	**2N6496**	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	150	120	150	150	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:						
With –1.5 volts (V_{BE}) of reverse bias and external base-to-emitter resistance (R_{BE}) = 100Ω	V_{CEX}(sus)	150	120	–	–	V
* With external base-to-emitter resistance (R_{BE}) = 500Ω, L = 7mH	V_{CEX}	–	–	130	–	V
With $R_{BE} \leqslant 50\Omega$	V_{CER}(sus)	110	95	–	130	V
With base open	V_{CEO}(sus)	90	75	120	110	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	7	6.5	7	V
*CONTINUOUS COLLECTOR CURRENT	I_C	20	20	10	15	A
*PEAK COLLECTOR CURRENT	I_{CM}	30	30	12	–	A
*CONTINUOUS BASE CURRENT	I_B	5	5	5	5	A
*TRANSISTOR DISSIPATION:	P_T					
At case temperatures up to 25°C and V_{CE} up to 28 V		140	140	140	140	W
At case temperature of 100°C and V_{CB} of 20 V		80	80	80	80	W
At case temperatures above 25°C		Derate linearly to 200°C				
*TEMPERATURE RANGE:						
Storage & Operating (Junction)		–65 to 200				°C
PIN TEMPERATURE (During soldering) At distances ⩾ 1/32 in. (0.8 mm) from seating plane for 10 s max.		230				

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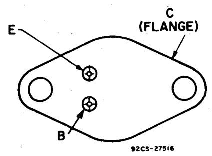
* In accordance with JEDEC registration data format (JS-6, RDF-1)

TERMINAL DESIGNATIONS



JEDEC TO-3

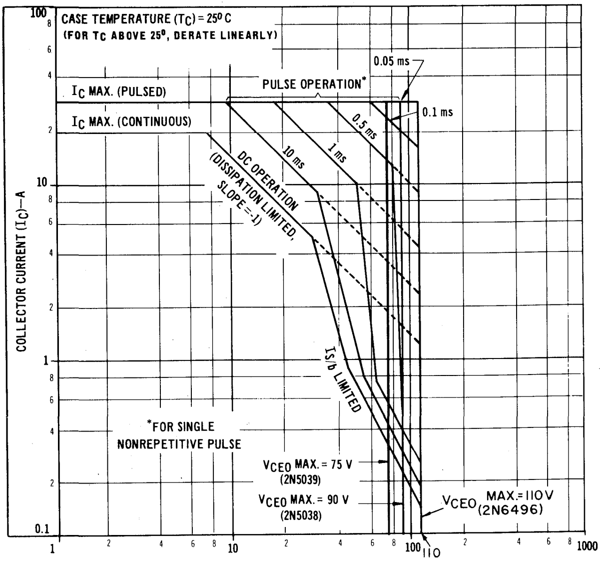


Fig. 1 – Maximum operating areas for 2N5038, 2N5039, 2N6496.

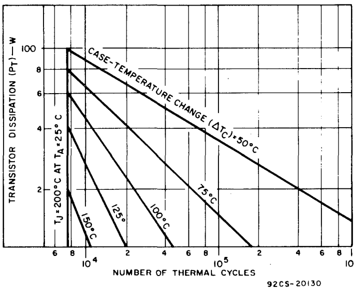


Fig. 2 – Thermal-cycling rating chart for all types.

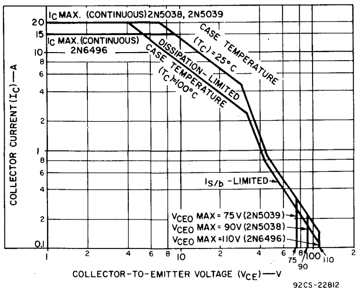


Fig. 3 – Maximum operating areas for 2N5038, 2N5039, 2N6496.

2N5038, 2N5039, 2N6354, 2N6496

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTICS	SYMBOL	TEST CONDITIONS				LIMITS								UNITS
		VOLTAGE V dc		CURRENT A dc		2N5038		2N5039		2N6354		2N6496		
		V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
* Collector-Cutoff Current: With emitter open V_{CB} = 150 V	I_{CBO}					–	–	–	–	–	5	–	–	mA
With base open	I_{CEO}	55			0	–	–	–	20	–	–	–	–	mA
		70			0	–	20	–	–	–	–	–	–	
		100				–	–	–	–	–	20	–	–	
* With base-emitter junction reverse-biased	I_{CEV}	110	-1.5			–	–	–	50	–	–	–	–	mA
		130	0			–	–	–	–	–	–	–	20	
		140	-1.5			–	50	–	–	–	–	–	–	
		140	0			–	–	–	–	–	10	–	–	
* At T_C = 150°C		85	-1.5			–	–	–	10	–	–	–	–	
		100	-1.5			–	10	–	–	–	–	–	–	
		130	0			–	–	–	–	–	–	–	25	
* At T_C = 125°C		140	0			–	–	–	–	–	20	–	–	
* Emitter Cutoff Current	I_{EBO}		-5	0		–	5	–	15	–	–	–	–	mA
			-6.5	0		–	–	–	–	–	5	–	–	
			-7	0		–	50	–	50	–	–	–	50	
* DC Forward-Current Transfer Ratio	h_{FE}	2		5^a		–	–	–	–	20	150	–	–	
*		2		8^a		–	–	–	–	–	–	12	100	
*		2		10^a		–	–	–	–	10	100	–	–	
		5		2^a		50	250	30	250	–	–	–	–	
*		5		10^a		–	–	20	100	–	–	–	–	
*		5		12^a		20	100	–	–	–	–	–	–	
* Magnitude of Small-Signal Forward-Current Transfer Ratio: f = 5 MHz	$\|h_{fe}\|$	10		2		12	–	12	–	–	–	12	–	
f = 10 MHz		10		1		–	–	–	–	8	–	–	–	
Collector-to-Emitter Sustaining Voltage With base open	$V_{CEO}(sus)$			0.2^a	0	90^b	–	75^b	–	120^b	–	100^b	–	V
With base-emitter junction reverse biased and external base-to-emitter resistance (R_{BE}) = 100Ω	$V_{CEX}(sus)$		-1.5	0.2	0	150^b	–	120^b	–	–	–	–	–	
With $R_{BE} \leqslant 50\Omega$				0.2	0	110^b	–	95^b	–	–	–	130^b	–	
$\leqslant 100\Omega$				0.2		–	–	–	–	130^b	–	–	–	
Emitter-to-Base Voltage: I_E = 0.05 A	V_{EBO}			0		7	–	7	–	–	–	7	–	V
* = 0.005 A				0		–	–	–	–	6.5	–	–	–	
Base-to-Emitter Voltage	V_{BE}	2		8^a		–	–	–	–	–	–	–	1.6	V
		5		10^a		–	–	–	1.8	–	–	–	–	
		5		12^a		–	1.8	–	–	–	–	–	–	
* Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$			8^a	0.8	–	–	–	–	–	–	–	1.0	V
*				5^a	0.5	–	–	–	–	–	0.5	–	–	
				10^a	1.0	–	–	–	1.0	–	1	–	–	
				12^a	1.2	–	1.0	–	–	–	–	–	–	
*				20^a	5	–	2.5	–	2.5	–	–	–	–	
* Base-to-Emitter Saturation Voltage	$V_{BE}(sat)$			5^a	0.5	–	–	–	–	–	1.3	–	–	V
*				8^a	0.8	–	–	–	–	–	–	–	2.0	
*				10^a	1	–	–	–	–	–	2	–	–	
				20^a	5	–	3.3	–	3.3	–	–	–	–	
Output Capacitance: V_{CB} = 10V, f = 1 MHz	C_{ob}					–	400	–	400	–	400	–	400	pF
Forward-Bias Second Breakdown Collector Current: t = 1s, nonrepetitive	$I_{S/b}$	25				–	–	–	–	5.5	–	–	–	A
		28				5.0	–	5.0	–	–	–	5.0	–	
		45				0.9	–	0.9	–	–	–	0.9	–	
Second-Breakdown Energy: With base reverse biased, R_{BE} = 51Ω, L = 25µH	$E_{S/b}$		-1	5		–	–	–	–	0.3	–	–	–	mJ
R_B = 20Ω, L = 180µH			-4	13		13	–	13	–	–	–	–	–	
			-4	8		–	–	–	–	–	–	5.7	–	
* Saturated Switching Time (V_{CC} = 30 V, $I_{B_1} = I_{B_2}$): Rise Time	t_r			5	0.5	–	–	–	–	–	0.3	–	–	µs
				8	0.8	–	–	–	–	–	–	–	0.5	
				10	1.0	–	–	–	0.5	–	1	–	–	
				12	1.2	–	0.5	–	–	–	–	–	–	
* Storage Time	t_{s_1}			5	0.5	–	–	–	–	–	1	–	–	
				8	0.8	–	–	–	–	–	–	–	1.5	
				10	1.0	–	–	–	1.5	–	–	–	–	
				12	1.2	–	1.5	–	–	–	–	–	–	
Storage Time (No Load)	t_{s_2}			0.5	0.5	–	–	–	–	–	2	–	–	
* Fall Time				5	0.5	–	–	–	–	–	0.2	–	–	
				8	0.8	–	–	–	–	–	–	–	0.5	
				10	1.0	–	–	–	0.5	–	–	–	–	
				12	1.2	–	0.5	–	–	–	–	–	–	
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$	10		10		–	1.25	–	1.25	–	–	–	1.25	°C/W
		20		1		–	–	–	–	–	1.25	–	–	

* In accordance with JEDEC registration data format (JS-6, RDF-1).

[a] Pulsed; pulse duration ⩽ 350µs, duty factor = 2%.

[b] CAUTION: The sustaining voltages $V_{CEO}(sus)$, $V_{CER}(sus)$, and $V_{CEX}(sus)$ MUST NOT be measured on a curve tracer.

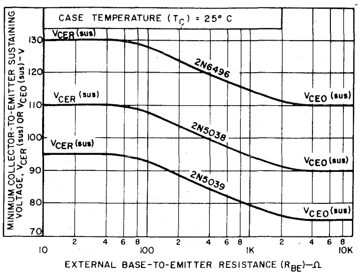


Fig. 4 Collector-to-emitter sustaining voltage characteristics for 2N5038, 2N5039 and 2N6496.

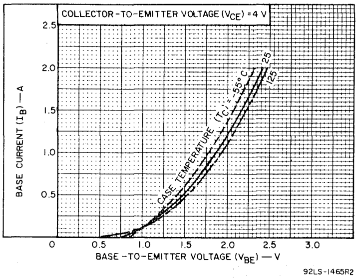


Fig. 5 — Typical input characteristics for 2N5038 and 2N5039.

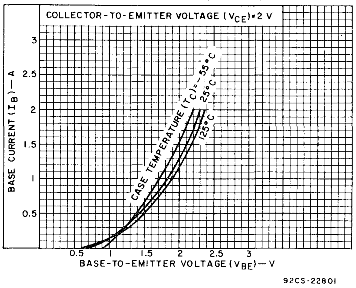


Fig. 6 — Typical input characteristic for 2N6496.

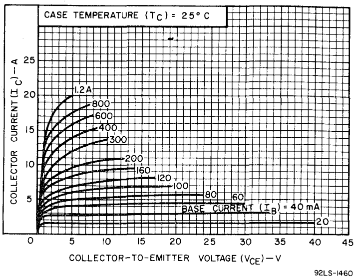


Fig. 7 — Typical output characteristics for 2N5038.

2N5038, 2N5039, 2N6354, 2N6496

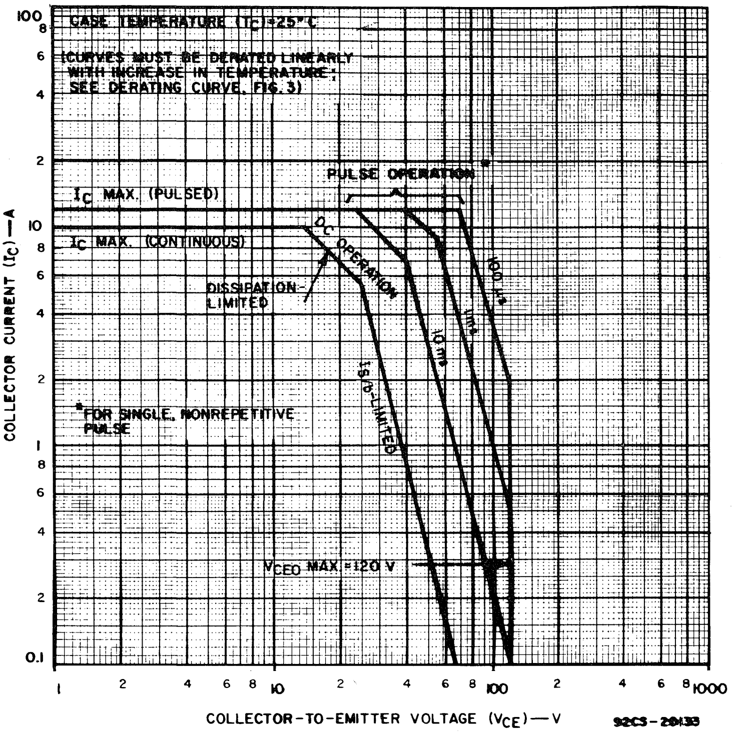


Fig. 8 — Maximum operating areas for 2N6354.

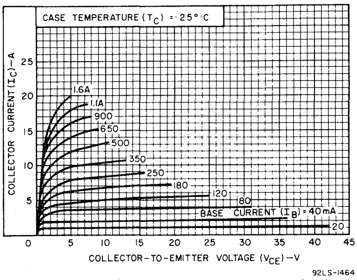


Fig. 9 — Typical output characteristics for 2N5039.

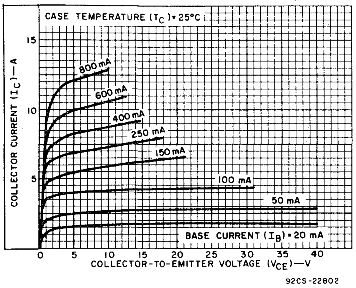


Fig. 10 — Typical output characteristics for 2N6496.

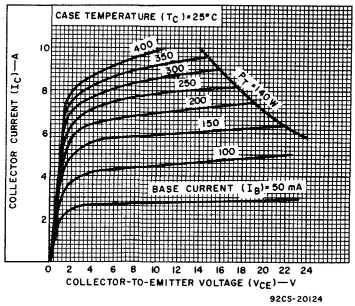


Fig. 12 — Typical output characteristics for 2N6354.

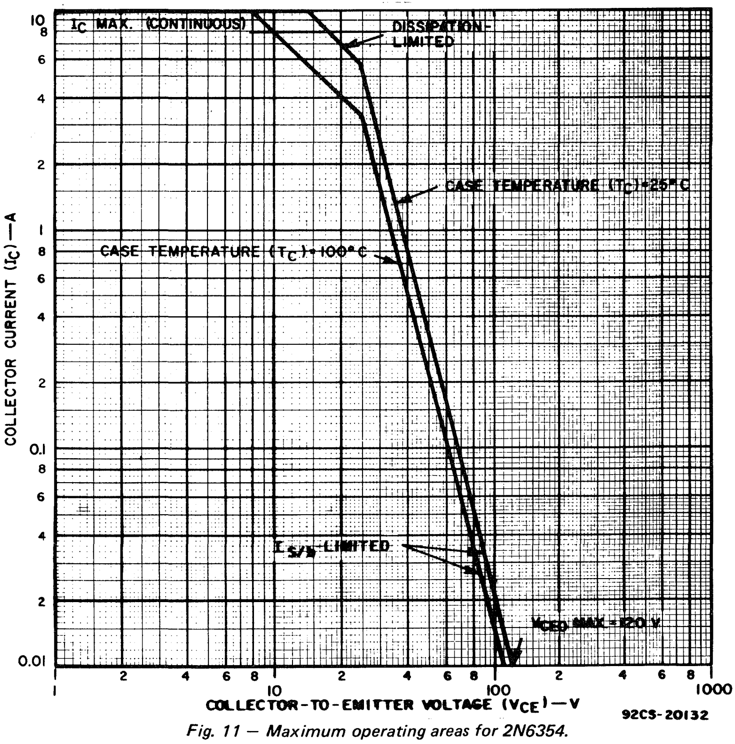


Fig. 11 — Maximum operating areas for 2N6354.

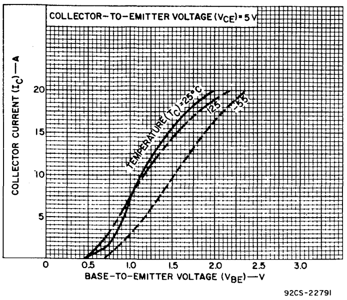


Fig. 13 — Typical transfer characteristics for 2N5038.

2N5038, 2N5039, 2N6354, 2N6496

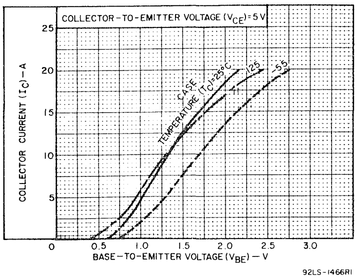


Fig. 14 — Typical transfer characteristics for 2N5039.

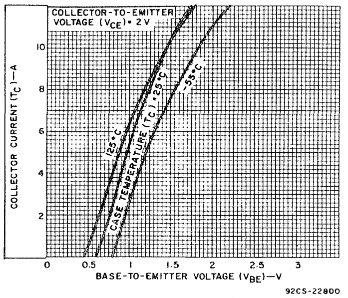


Fig. 15 — Typical transfer characteristics for 2N6496 ·

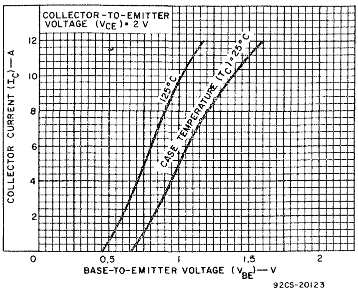


Fig. 16 — Typical transfer characteristics for 2N6354.

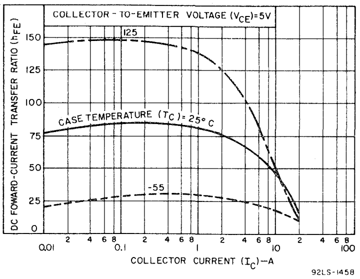


Fig. 17 — Typical dc beta characteristics for 2N5038.

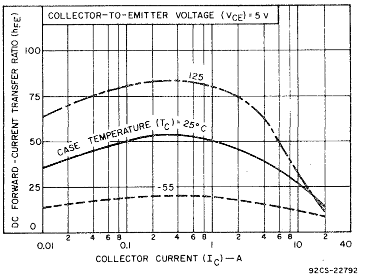


Fig. 18 — Typical dc beta characteristics for 2N5039.

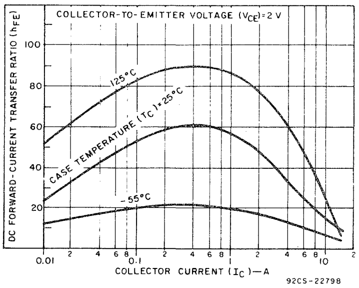


Fig. 19 — Typical dc beta characteristics for 2N6496.

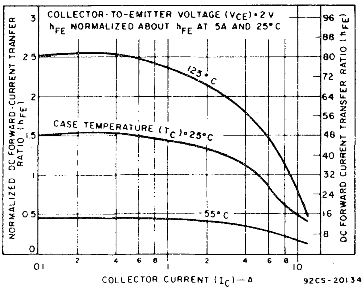


Fig. 20 — Typical normalized dc beta characteristics for 2N6354.

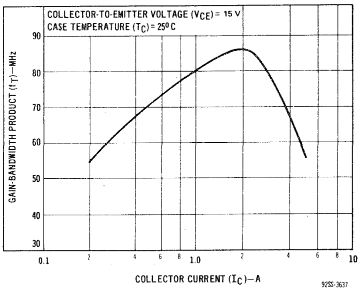


Fig. 21 — Typical gain-bandwidth product for 2N5038, 2N5039, 2N6496.

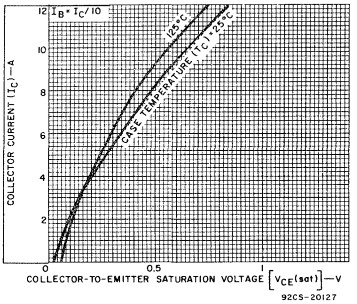


Fig. 22 — Typical saturation voltage characteristics for 2N6354.

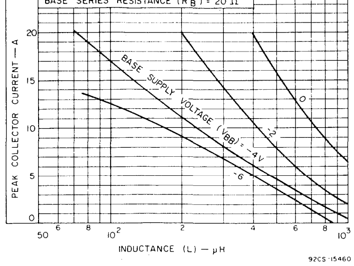


Fig. 23 — Maximum reverse-bias, second-breakdown characteristics for 2N5038 and 2N5039.

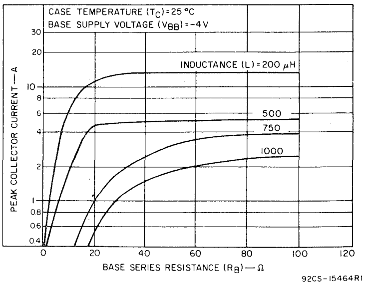


Fig. 24 — Maximum reverse-bias, second-breakdown characteristics for 2N5038 and 2N5039.

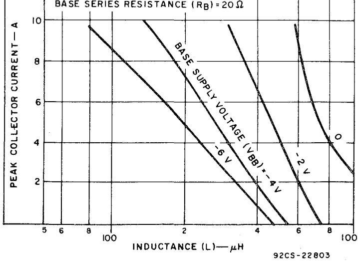


Fig. 25 — Maximum reverse-bias, second-breakdown characteristics for 2N6496.

2N5038, 2N5039, 2N6354, 2N6496

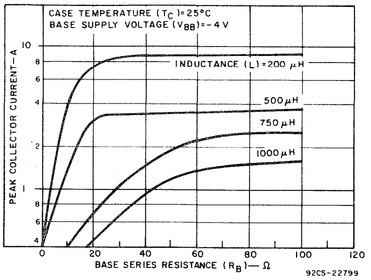


Fig. 26 — Maximum reverse-bias, second-breakdown characteristics for 2N6496.

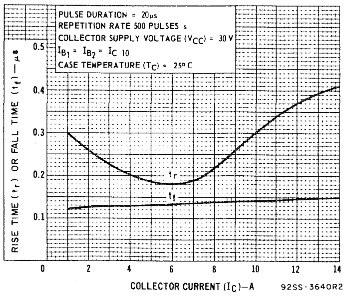


Fig. 27 — Typical rise-time and fall-time characteristics for 2N5038, 2N5039, 2N6496.

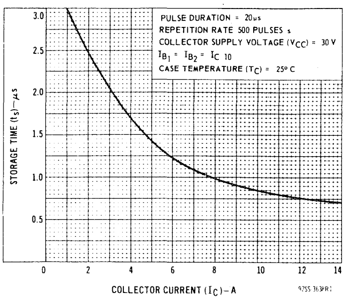


Fig. 28 — Typical storage time characteristics for 2N5038, 2N5039, 2N6496.

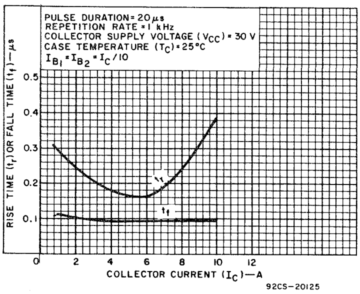


Fig. 29 — Typical rise- and fall-time characteristics for 2N6354.

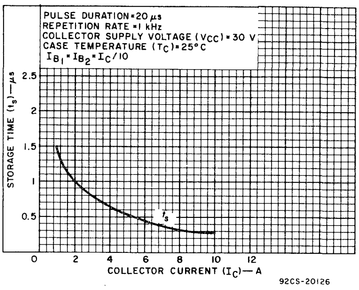


Fig. 30 — Typical storage-time characteristics for 2N6354.

2N5239, 2N5240

Silicon N-P-N Power Transistors

High-Voltage, High-Power Types for Applications in Industrial and Commercial Service

The RCA-2N5239 and 2N5240 are multiple epitaxial silicon n-p-n power transistors employing a new overlay construction with several emitter sites.

The high breakdown voltage ratings and exceptional second-breakdown capabilities of these transistors make them especially suitable for use in series regulators, power amplifiers, inverters, deflection circuits, switching regulators, and high-voltage bridge amplifiers.

All of these devices are supplied in the popular JEDEC TO-3 package; they differ in breakdown-voltage and leakage-current values.

Features:

- **High voltage ratings**
- **High power-dissipation ratings**
- **For switching applications where circuit values and operating conditions require a transistor with a high second breakdown rating ($I_{S/b}$) (limit line begins at 150 V)**
- **Maximum area-of-operation curves for dc and pulse operation**
- **High-voltage ratings for operation from power lines without a step-down transformer (40852)**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	2N5239	2N5240	
*COLLECTOR-TO-BASE VOLTAGE, V_{CBO}	300	375	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:			
* With base open, V_{CEO}(sus)	225	300	V
With external base-to-emitter resistance (R_{BE}) ⩽50 Ω, V_{CER}(sus)	250	350	V
*EMITTER-TO-BASE VOLTAGE, V_{EBO}	6	6	V
*COLLECTOR CURRENT, I_C	5	5	A
PEAK COLLECTOR CURRENT, I_{CM}	–	–	A
*BASE CURRENT, I_B	2	2	A
*TRANSISTOR DISSIPATION, P_T:			
At case temperatures up to 25°C and V_{CE} up to 150 V	100	100	W
At case temperatures up to 25°C and V_{CE} above 150 V	See Fig. 6		
At case temperatures above 25°C and V_{CE} above 150 V	See Figs. 1 & 6		
*TEMPERATURE RANGE:			
Storage & Operating (Junction)	−65 to +200		°C
*PIN TEMPERATURE (During Soldering)			
At distance ⩾ 1/32 in. (0.79 mm) from seating plane for 10 s max	230		°C

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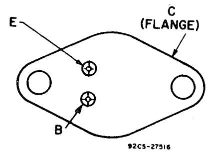
*In accordance with JEDEC registration data format (JS-6, RDF-2)

TERMINAL DESIGNATIONS



JEDEC TO-3

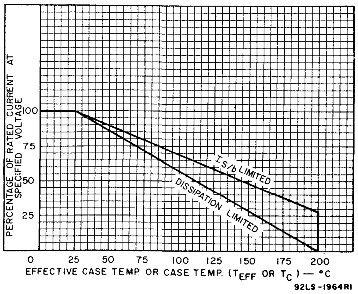


Fig. 1—Dissipation derating curves for all types.

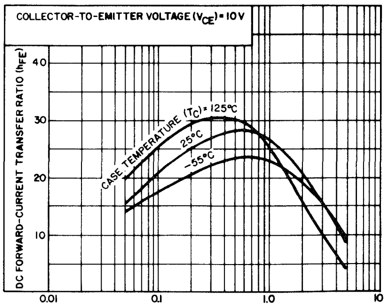


Fig. 2—Typical dc-beta characteristics for all types.

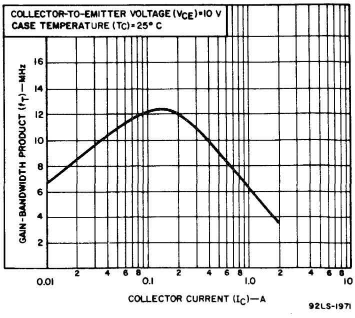


Fig. 3—Typical gain-bandwidth product for all types.

2N5239, 2N5240

ELECTRICAL CHARACTERISTICS, *Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	TEST CONDITIONS				LIMITS				UNITS
	VOLTAGE V dc		CURRENT A dc		2N5239		2N5240		
	V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	
* I_{CEO}	200			0	–	5.0	–	2.0	mA
* I_{CEV}	300 375 450	–1.5 –1.5 –1.5			– – –	4.0 – –	– – –	– 2.0 –	mA
I_{CEV} T_C = 125°C	450	–1.5			–	–	–	–	
I_{CEV} (T_C = 150°C)	300	–1.5			–	5.0	–	3.0	mA
* I_{EBO}		–5.0	0		–	5.0	–	1.0	mA
* V_{CEO}(sus)			0.2	0	225[b]	–	300[b]	–	V
V_{CER}(sus)			0.2	0	250[b]	–	350[b]	–	V
* V_{EBO}				–0.02 –0.1	6 –	– –	6 –	– –	V
V_{BE}(sat)					–	–	–	–	V
* V_{BE}	10	–	2.0[a]	–	–	3.0	–	3.0	V
* V_{CE}(sat)	– –	– –	2.0[a] 4.5[a] 4[a]	0.25 1.125 0.8	– – –	2.5 5 –	– – –	2.5 5 –	V
* h_{FE}	1 10 10 10	 – – –	1.2[a] 0.4[a] 2.0[a] 4.5[a]	 – – –	– 20 20 5	– 80 80 –	– 20 20 5	– 80 80 –	
C_{ob} (At 1 MHz) (V_{CB} = 10V, I_E = 0)	–	–	–	–	–	150	–	150	pF
* $I_{S/b}$ (t_p = I_s)	40 150	 –	 –	 –	– 0.67	– –	– 0.67	– –	A
$E_{S/b}$ (R_{BE} = 50 Ω L = 0.2 mH, L = 100 μH)	–	–4.0 –4	4.0 3[c]	–	1.6 –	– –	1.6 –	– –	mJ
f_T	10	–	0.2	–	5.0	–	5.0	–	MHz
* $\|h_{fe}\|$ (at 1 MHz)	10	–	0.2	–	5.0	–	5.0	–	
* h_{fe} (at 1 kHz)	10	–	4.0	–	20	–	20	–	
$R_{\theta JC}$	–	–	–	–	–	1.75	–	1.75	°C/W

*In accordance with JEDEC registration data format (JS-6, RDF-2) (2N5239, 2N5240).

[a] Pulsed; pluse duration ⩽ 300 μs, duty factor = 2%.

[b] CAUTION: The sustaining voltages V_{CEO}(sus) and V_{CER}(sus) MUST NOT be measured on a curve tracer.

[c] I_{CM}

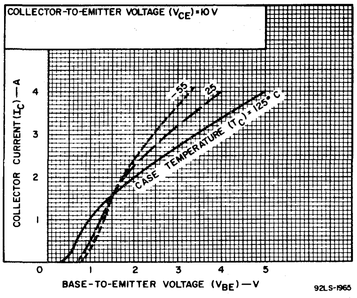


Fig. 4—Typical transfer characteristics for all types.

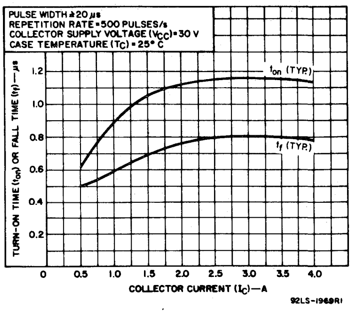


Fig. 5—Saturated switching time (storage) vs. collector current for types 2N5239 & 2N5240.

2N5239, 2N5240

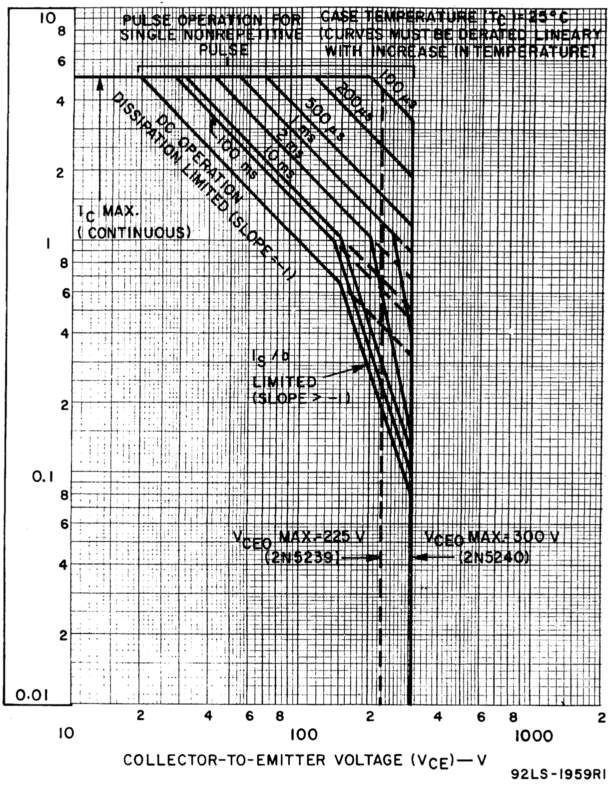


Fig. 6—Maximum operating areas for 2N5239 & 2N5240.

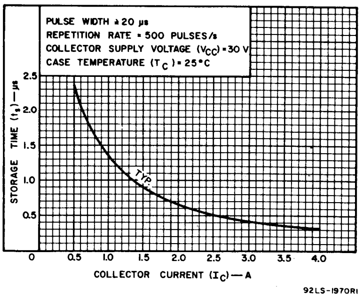


Fig. 7—Saturated switching time (storage) vs. collector current for types 2N5239 & 2N5240.

2N5293-2N5298, RCA3054

Hometaxial-Base, Silicon N-P-N VERSAWATT Transistors

General-Purpose Types for Medium-Power Switching and Amplifier Applications in Military, Industrial, and Commercial Equipment

RCA-2N5293, 2N5294, 2N5295, 2N5296, 2N5297, 2N5298, and RCA3054 are hometaxial-base silicon n-p-n transistors. They are intended for a wide variety of medium-power switching and amplifier applications such as series and shunt regulators, and in driver and output stages of high-fidelity amplifiers. Types 2N5293, 2N5295, and 2N5297 have formed emitter and base leads for easy insertion into TO-66 sockets. Types 2N5294, 2N5296, and 2N5298 are electrically identical to the 2N5293, 2N5295, and 2N5297, respectively, but have straight leads. The RCA3054 is supplied with straight leads.

These plastic power transistors differ in voltage ratings and in the currents at which the parameters are controlled.

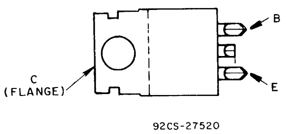
Features:

- **Low saturation voltage—**
  $V_{CE}(sat)$ = 1 V max. at I_C = 0.5 A (2N5293, 2N5294)
  = 1 V max. at I_C = 1 A (2N5295, 2N5296)
  = 1 V max. at I_C = 1.5 A (2N5297, 2N5298)
- **VERSAWATT package (molded-silicone plastic)**
- **Maximum safe-area-of-operation curves**

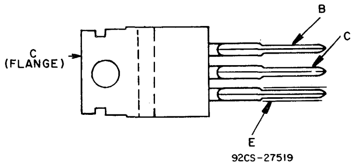
MAXIMUM RATINGS, *Absolute-Maximum Values:*

		2N5293 2N5294	2N5295 2N5296	2N5297 2N5298	RCA3054	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	80	60	80	90	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:						
With −1.5 volts (V_{BE}) of reverse bias	$V_{CEV}(sus)$	80	60	80	90	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	$V_{CER}(sus)$	75	50	70	60	V
With base open	$V_{CEO}(sus)$	70	40	60	55	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	5	5	7	V
COLLECTOR CURRENT	I_C	4	4	4	4	A
BASE CURRENT	I_B	2	2	2	2	A
TRANSISTOR DISSIPATION:	P_T					
At case temperatures up to 25°C		36	36	36	36	W
At case temperatures above 25°C		Derate linearly at 0.288				W/°C
At ambient temperatures up to 25°C		1.8	1.8	1.8	1.8	W
At ambient temperatures above 25°C		Derate linearly at 0.0144				W/°C
TEMPERATURE RANGE:						
Storage and Operating (Junction)		−65 to +150				°C
LEAD TEMPERATURE (During soldering):						
At distance ≥ 1/8 in. (3.17 mm) from case for 10 s max.		235				°C

TERMINAL DESIGNATIONS



JEDEC TO-220AA
2N5293, 2N5295, 2N5297



JEDEC TO-220AB
2N5294, 2N5296, 2N5298, RCA3054

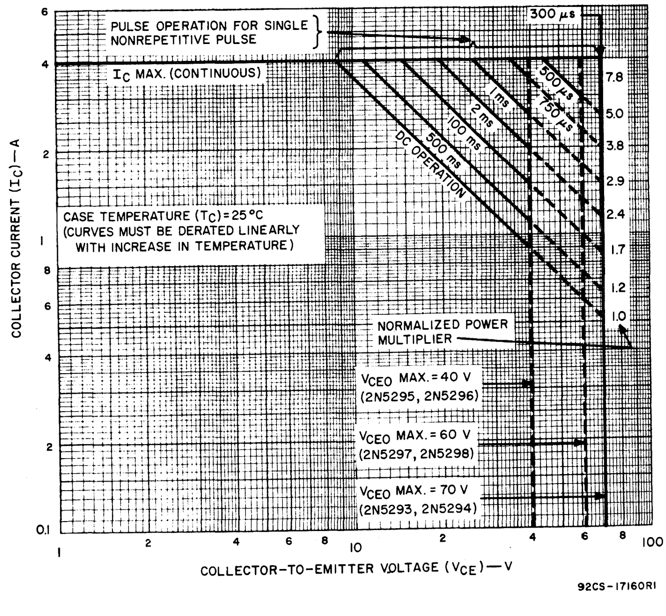


Fig. 1 – Maximum operating areas for 2N5293–2N5298.

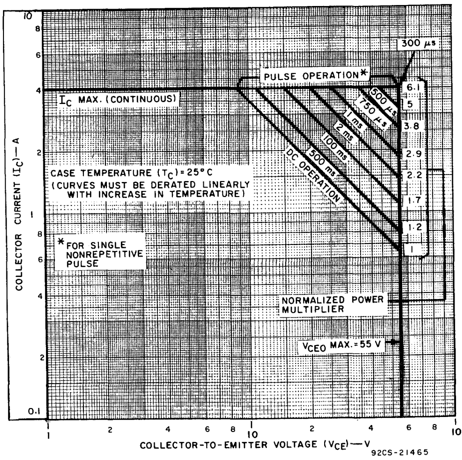


Fig. 2 – Maximum operating areas for RCA3054.

2N5293-2N5298, RCA3054

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C, unless otherwise specified.*

CHARACTERISTIC SYMBOL	TEST CONDITIONS				LIMITS								UNITS
	VOLTAGE V dc		CURRENT A dc		2N5293 2N5294		2N5295 2N5296		2N5297 2N5298		**RCA3054**		
	V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX	MIN.	MAX	MIN.	MAX.	
I_{CEV} •	90	-1.5			–	–	–	–	–	–	–	1	mA
	65	-1.5			–	0.5	–	–	–	0.5	–	–	
	35	-1.5			–	–	–	2	–	–	–	–	
I_{CEV} • (T_C = 150°C)	90	-1.5			–	–	–	–	–	–	–	6	
	65	-1.5			–	3	–	–	–	3	–	–	
	35	-1.5			–	–	–	5	–	–	–	–	
I_{CER} (R_{BE} = 100 Ω)	50				–	0.5	–	–	–	0.5	–	–	mA
	20				–	–	–	–	–	–	–	–	
I_{CER} (T_C = 150°C)	50				–	2	–	–	–	2	–	–	mA
I_{EBO}		-7	0		–	1	–	–	–	–	–	1	mA
		-5	0		–	–	–	1	–	1	–	–	
		-4	0		–	–	–	–	–	–	–	–	
h_{FE}[c]	4		0.5		30	120	–	–	–	–	25	100	
	4		1		–	–	30	120	–	–	–	–	
	4		1.5			–	–	–	20	80	–	–	
$V_{CEO}(sus)$[c]			0.1	0	70	–	–	–	–	–	55	–	V
			0.1	0	–	–	40	–	–	–	–	–	
			0.1	0	–	–	–	–	60	–	–	–	
$V_{CER}(sus)$[c] (R_{BE} = 100 Ω)			0.1		75	–	–	–	–	–	–	–	V
			0.1		–	–	50	–	–	–	–	–	
			0.1		–	–	–	–	70	–	60	–	
$V_{CEV}(sus)$[c]		-1.5	0.1		80	–	–	–	–	–	–	–	V
		-1.5	0.1		–	–	60	–	–	–	–	–	
		-1.5	0.1		–	–	–	–	80	–	90	–	
V_{BE}[c]	4		0.5		–	1.1	–	–	–	–	–	1.7	V
	4		1		–	–	–	1.3	–	–	–	–	
	4		1.5		–	–	–	–	–	1.5	–	–	
$V_{CE}(sat)$[c]			0.5	0.05	–	1	–	–	–	–	–	1	V
			1	0.05	–	–	–	–	–	–	–	–	
			1	0.1	–	–	–	1	–	–	–	–	
			1.5	0.15	–	–	–	–	–	1	–	–	
f_T	4		0.2		0.8	–	0.8	–	0.8	–	0.8	–	MHz
t_{ON}	V_{CC} = 30		0.5	0.05[a]	–	5	–	–	–	–	–	–	μs
			1	0.1[a]	–	–	–	5	–	–	–	–	
			1.5	0.15[a]	–	–	–	–	–	5	–	–	
t_{OFF}	V_{CC} = 30		0.5	-0.5[a]	–	15	–	–	–	–	–	–	μs
			1	-0.1[b]	–	–	–	15	–	–	–	–	
			1.5	-0.15[b]	–	–	–	–	–	15	–	–	
$R_{\theta JC}$					–	3.5	–	3.5	–	3.5	–	3.5	°C/W
$R_{\theta JA}$					–	70	–	70	–	70	–	70	°C/W

[a] I_{B1} value (turn-on base current).

[b] I_{B2} value (turn-off base current).

[c] Pulsed, pulse duration = 300 μs, duty factor = .018.

• I_{CEX} for RCA3054.

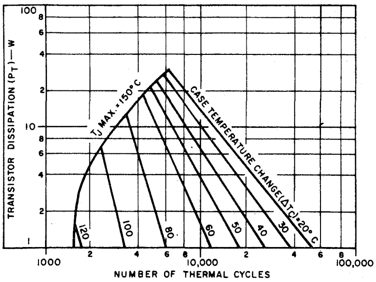


Fig. 3 – Thermal-cycling rating chart for all types.

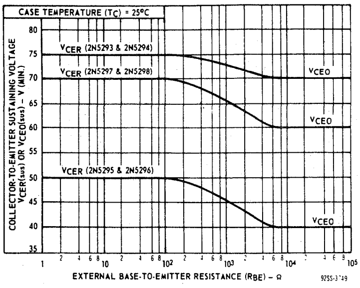


Fig. 4 – Sustaining voltage vs. base-to-emitter resistance for 2N5293–2N5298.

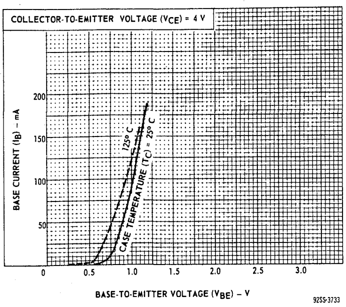


Fig. 5 – Typical input characteristics for 2N5293, 2N5294, and RCA3054.

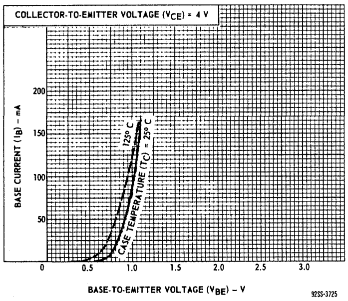


Fig. 6 – Typical input characteristics for 2N5295 and 2N5296.

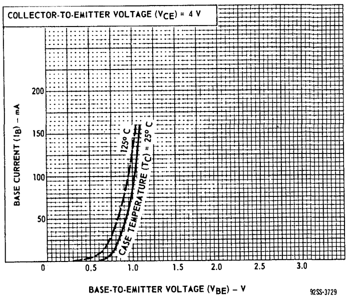


Fig. 7 – Typical input characteristics for types 2N5297 and 2N5298.

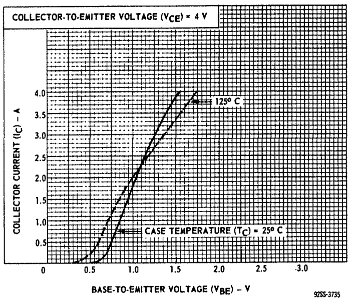


Fig. 8 – Typical transfer characteristics for 2N5293, 2N5294, and RCA3054.

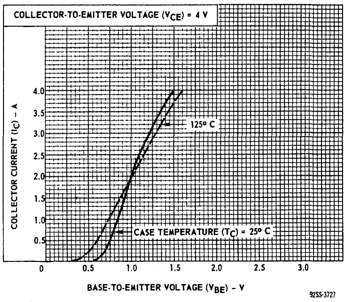


Fig. 9 – Typical transfer characteristics for 2N5295 and 2N5296.

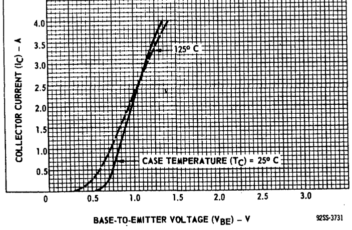


Fig. 10 – Typical transfer characteristics for 2N5297 and 2N5298.

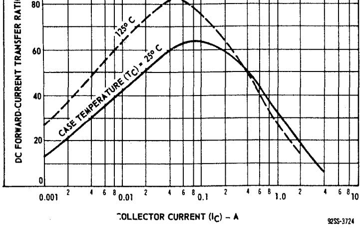


Fig. 11 – Typical dc beta for 2N5293, 2N5294, and RCA3054.

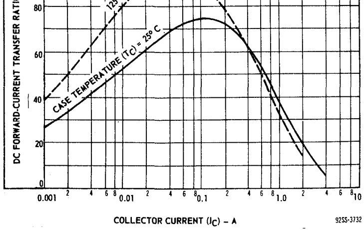


Fig. 12 – Typical dc beta for 2N5295, and 2N5196.

2N5293-2N5298, RCA3054

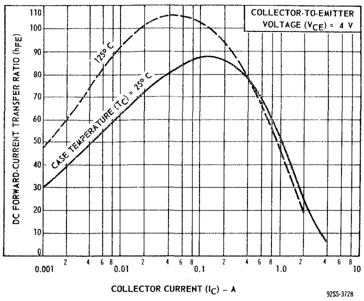


Fig. 13—Typical dc beta for 2N5297 and 2N5298.

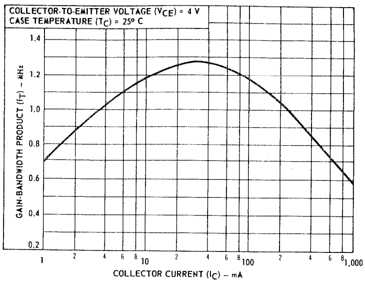


Fig. 14—Typical gain-bandwidth product for 2N5293, 2N5294, and RCA3054.

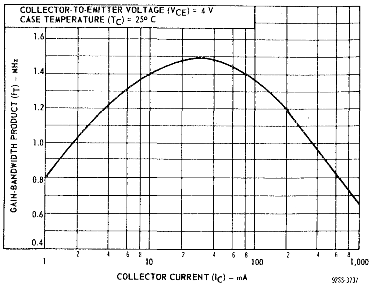


Fig. 15—Typical gain-bandwidth product for 2N5295 and 2N5296.

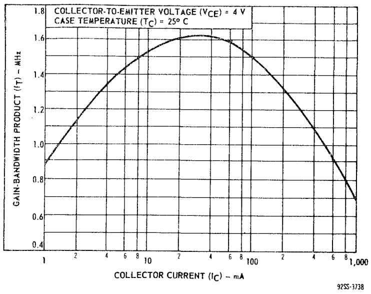


Fig. 16—Typical gain-bandwidth product for 2N5297 and 2N5298.

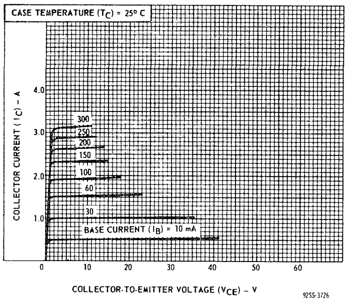


Fig. 17—Typical output characteristics for 2N5293, 2N5294, and RCA3054.

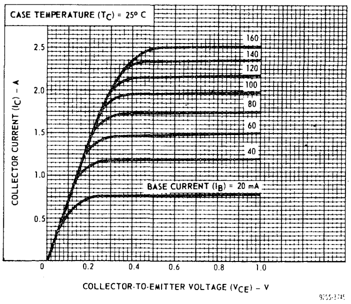


Fig. 18—Typical output characteristics for 2N5295 and 2N5296.

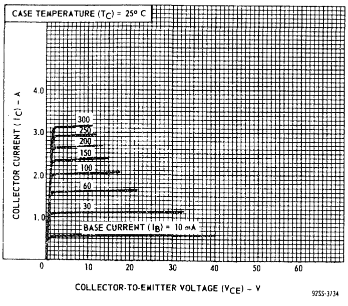


Fig. 19—Typical output characteristics for 2N5295 and 2N5296.

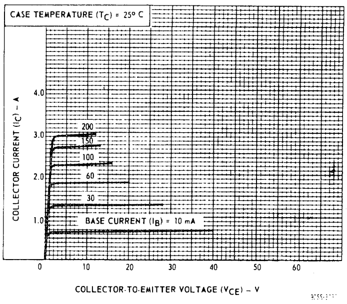


Fig. 20—Typical output characteristics for 2N5297 and 2N5298.

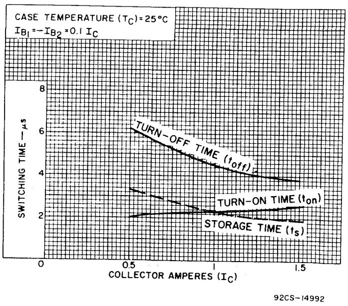


Fig. 21—Typical saturated switching characteristics for 2N5295, 2N5296, and RCA3054.

2N5320-2N5323

Complementary N-P-N & P-N-P Silicon Power Transistors

General-Purpose Types for Small-Signal, Medium-Power Applications

RCA-2N5320, 2N5321, 2N5322 and 2N5323 are double-diffused epitaxial-planar silicon power transistors intended for small-signal medium-power applications. The 2N5320 and 2N5321 n-p-n types are actually high-current, high-dissipation versions of the 2N2102 with all of the salinet features of that device. The 2N5322 and 2N5323, p-n-p complements of the 2N5320 and 2N5321, are actually high-current, high-power versions of the 2N4036 with all of its additional outstanding features. (Technical data on the 2N2102 and 2N4036 are shown on pages 29 and 71, respectively).

The devices are supplied in the JEDEC TO-39 hermetic package.

MAXIMUM RATINGS, *Absolute-Maximum Values:*		2N5321	2N5323	2N5320	2N5322	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	75	-75	100	-100	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:						
With 1.5 volts (V_{BE}) of reverse bias	$V_{CEV}(sus)$	75	-75	100	-100	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	$V_{CER}(sus)$	65	-65	90	-90	V
* With base open	$V_{CEO}(sus)$	50	-50	75	-75	V
* EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	-5	7	-7	V
* COLLECTOR CURRENT	I_C	2	-2	2	-2	A
* BASE CURRENT	I_B	1	-1	1	-1	A
* TRANSISTOR DISSIPATION:	P_T					
At case temperatures up to 25° C		10	10	10	10	W
At case temperatures above 25° C		Figs. 2 and 8 Derate linearly at 0.057 W/°C				
* TEMPERATURE RANGE:						
Storage and operating (Junction)		-65 to + 200				°C
* LEAD TEMPERATURE (During soldering):						
At distance ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max		230				°C

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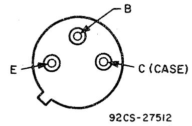
*In accordance with JEDEC registration data format (JS-6 RDF-1)

Features:

- 2N5322 / 2N5323 P-N-P Complements of: 2N5320 / 2N5321
- Maximum safe-area-of-operation curves
- Planar construction for low-noise and low-leakage characteristics
- Low saturation voltage
- High beta at high collector current

TERMINAL DESIGNATIONS



JEDEC TO-39

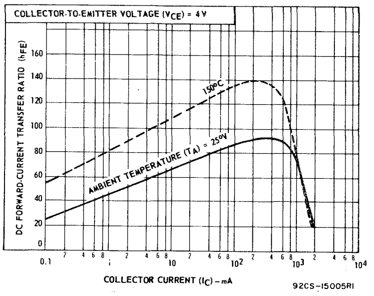
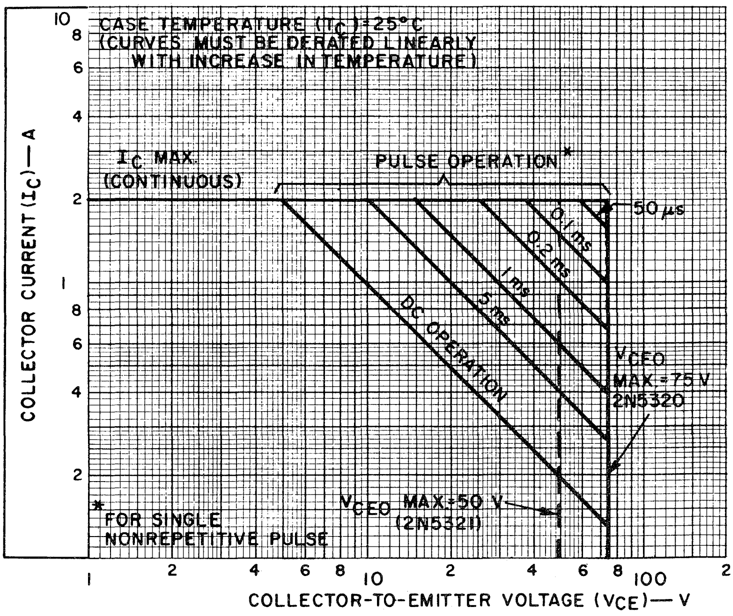


Fig. 1 - Typical static beta characteristics for types 2N5320 and 2N5321.



92CS-17548

Fig. 2 - Maximum operating areas for 2N5320 and 2N5321.

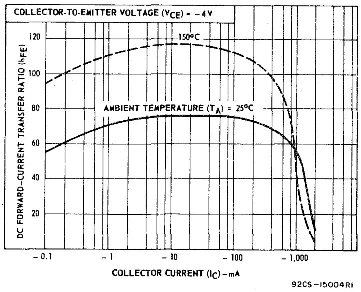


Fig. 3 - Typical static beta characteristics for 2N5322 and 2N5223.

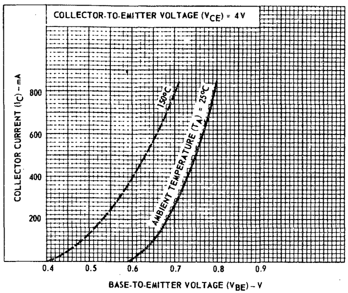


Fig. 4 - Typical transfer characteristics for 2N5320 and 2N5321.

2N5320-2N5323

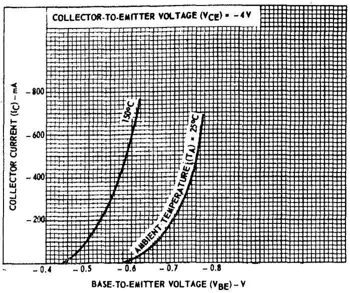


Fig. 5 - Typical transfer characteristics for 2N5322 and 2N5323.

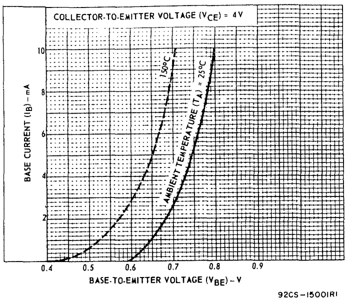


Fig. 6 - Typical input characteristics for 2N5320 and 2N5321.

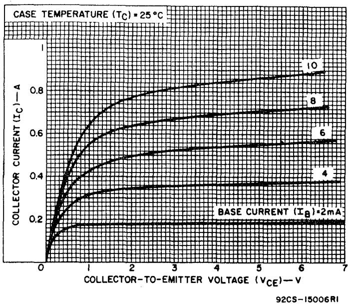


Fig. 7 - Typical output characteristics for 2N5320 and 2N5321.

ELECTRICAL CHARACTERISTICS, *Case Temperature (T_C) = 25° C Unless Otherwise Specified*

CHARACTERISTIC	Symbol	TEST CONDITIONS					LIMITS								Units
		DC Voltage V			DC Current mA		Type 2N5320		Type 2N5321		Type 2N5322		Type 2N5323		
		V_{CB}	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Collector-Cutoff Current: With base open (I_E = 0)	I_{CBO}	80					-	0.5	-	-	-	-	-	-	μA
		60					-	-	-	5	-	-	-	-	
		-80					-	-	-	-	-	-0.5	-	-	
		-60					-	-	-	-	-	-	-	-5	
* With base-emitter Junction reverse biased	I_{CEX}		100	-1.5			-	0.1	-	-	-	-	-	-	mA
			75	-1.5			-	-	-	0.1	-	-	-	-	
			-100	1.5			-	-	-	-	-	-0.1	-	-	
			-75	1.5			-	-	-	-	-	-	-	-0.1	
T_C=150°C			70	-1.5			-	5	-	-	-	-	-	-	mA
			45	-1.5			-	-	-	5	-	-	-	-	
			-70	1.5			-	-	-	-	-	-5	-	-	
			-45	1.5			-	-	-	-	-	-	-	-5	
* Emitter-Cutoff Current	I_{EBO}			-7	0		-	0.1	-	-	-	-	-	-	mA
				-5	0		-	-	-	0.1	-	-	-	-	
				7	0		-	-	-	-	-	-0.1	-	-	
				5	0		-	-	-	-	-	-	-	-0.1	
				-5	0		-	0.1	-	-	-	-	-	-	μA
				-4	0		-	-	-	0.5	-	-	-	-	
				5	0		-	-	-	-	-	-0.1	-	-	
				4	0		-	-	-	-	-	-	-	-0.5	
Collector-to-Emitter Breakdown Voltage: With base-emitter junction reverse biased	$V_{(BR)CEV}$			-1.5	0.1		100	-	75	-	-	-	-	-	V
				1.5	-0.1		-	-	-	-	-100	-	-75	-	
Collector-to-Emitter Sustaining Voltage: With external base-to-emitter resistance (R_{BE}) = 100 Ω	$V_{CER(sus)}{}^a$				100		90	-	65	-	-	-	-	-	V
					-100		-	-	-	-	-90	-	-65	-	
* With base open	$V_{CEO(sus)}{}^a$				100	0	75	-	50	-	-	-	-	-	V
					-100	0	-	-	-	-	-75	-	-50	-	
* Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$				500	50	-	0.5	-	0.8	-	-	-	-	V
					-500	-50	-	-	-	-	-	-0.7	-	-1.2	
* Base-to-Emitter Voltage	V_{BE}		4		500		-	1.1	-	1.4	-	-	-	-	V
			-4		-500		-	-	-	-	-	-1.1	-	-1.4	
* DC Forward Current Transfer Ratio	$h_{FE}{}^b$ See NOTE		4		500		30	130	40	250	-	-	-	-	
			-4		-500		-	-	-	-	30	130	40	250	
			2		1000		10	-	-	-	-	-	-	-	
			-2		-1000		-	-	-	-	10	-	-	-	
Gain-Bandwidth Product	f_T		4		50		50	-	50	-	-	-	-	-	MHz
			-4		-50		-	-	-	-	50	-	50	-	
* Magnitude of common-emitter, small-signal, short circuit, forward current transfer ratio (f=10 MHz)	$\|h_{fe}\|$		4		50		5	-	5	-	-	-	-	-	
			-4		-50		-	-	-	-	5	-	5	-	

ELECTRICAL CHARACTERISTICS, (Cont'd)

CHARACTERISTIC	Symbol	TEST CONDITIONS					LIMITS								Units
		DC Voltage V			DC Current mA		Type 2N5320		Type 2N5321		Type 2N5322		Type 2N5323		
		V_{CB}	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Second Breakdown Collector Current[c] (With base forward biased)	$I_{S/b}$		50 -35				200 -	- -	200 -	- -	- -285	- -	- -285	- -	mA
* Sat. Switching Time: Turn-on Time	t_{on}		30 -30		500 -500	50 -50	- -	80 -	- -	80 -	- -	- 100	- -	- 100	ns
Turn-off Time	t_{off}		30 -30		500 -500	50 -50	- -	800 –	- -	800 -	– -	– 1000	- -	- 1000	ns
* Thermal Resistance: Junction-to-Case	$R_{\theta JC}$						-	17.5	-	17.5	-	17.5	-	17.5	°C/W
Junction-to-Ambient	$R_{\theta JA}$						-	150	-	150	-	150	-	150	°C/W

[a] CAUTION: The sustaining voltages $V_{CEO}(sus)$ and $V_{CER}(sus)$ MUST NOT be measured on a curve tracer.

[b] Pulsed; pulse duration < 300 μs, duty factor < 0.02.

[c] Pulsed; 0.4s non-repetitive pulse.

[d] $I_{S/b}$ is defined as the current at which second breakdown occurs at junction forward biased for transistor operation in the active region.

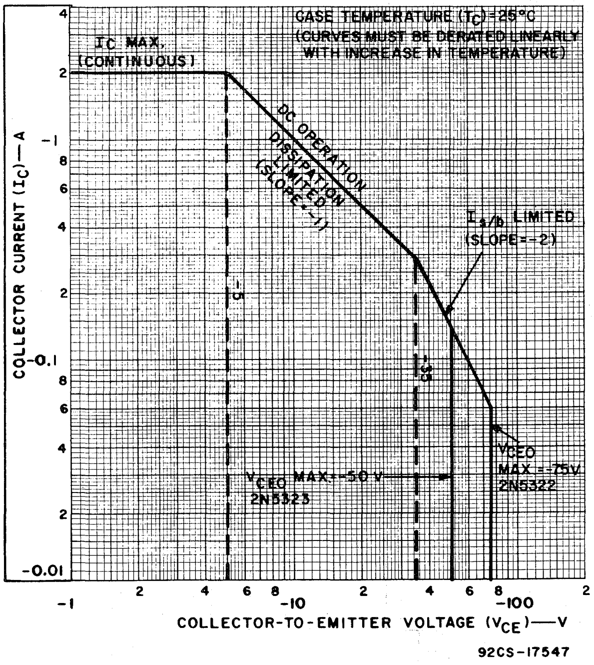


Fig. 8 - Maximum operating areas for 2N5322 and 2N5323.

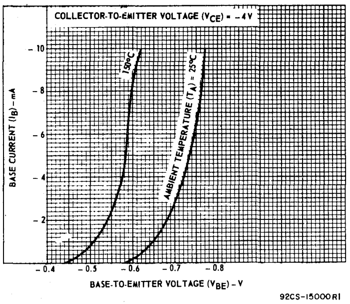


Fig. 9 - Typical input characterisitcs for 2N5322 and 2N5323.

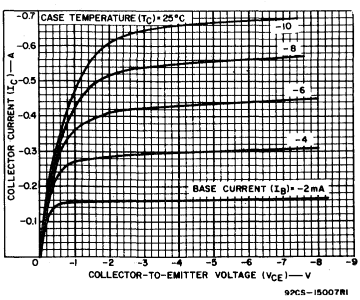


Fig. 10 - Typical output characteristics for 2N5322 and 2N5323.

2N5415, 2N5416, RCS880-RCS882

Silicon P-N-P High-Voltage Transistors

For High-Speed Switching and Linear-Amplifier
Applications in Military, Industrial and Commercial Equipment

The RCA-2N5415, 2N5416 and RCS880, RCS881, and RCS882 are silicon p-n-p transistors with high breakdown voltages, high frequency response, and fast switching speeds. All of these types are supplied in the JEDEC TO-39 hermetic package.

These transistors differ primarily in their voltage ratings. Typical applications include high-voltage differential and operational amplifiers; high-voltage inverters; and high-voltage, low-current switching and series regulators.

Features:

- **2N5415: p-n-p complement of 2N3440**
- **2N5415: p-n-p complement of 2N3439**
- **Maximum safe-area-of-operation curves**
- **High voltage ratings:**
  V_{CBO} = −350 V max. (2N5416)
  V_{CEO}(sus) = −300 V max. (2N5416, RCS882)
  −250 V max. (RCS881)
  −200 V max. (2N5415)
  −150 V max. (RCS880)

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		2N5415	2N5416	RCS880	RCS881	RCS882	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	−200	−350	−	−250	−350	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:							
With external base-to-emitter resistance (R_{BE}) = 50 Ω	V_{CER}(sus)	−	−350	−	−	−350	V
With base open	V_{CEO}(sus)	−200	−300	−150	−250	−300	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	−4	−6	−	−4	−6	V
*COLLECTOR CURRENT	I_C	−1	−1	−1	−1	−1	A
*BASE CURRENT	I_B	−0.5	−0.5	−0.5	−0.5	−0.5	A
*TRANSISTOR DISSIPATION:	P_T						
At case temperatures up to 25°C		10	10	7.5	7.5	7.5	W
At case temperatures above 25°C		Derate linearly to 200°C					
At ambient temperatures up to 50°C		1	1	0.75	0.75	0.75	W
At ambient temperatures above 50°C	Derate linearly at	6.7	6.7	5	5	5	mW/°C
*TEMPERATURE RANGE:							
Storage and Operating (Junction)		−65 to +200					°C
*LEAD TEMPERATURE (During soldering):							
At distance ⩾ 1/32 in. (0.8 mm) from seating plane for 10 s max.		255					°C

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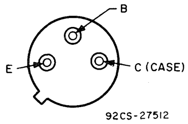
*2N-Series types in accordance with JEDEC registration data format (JS-9 RDF-8)

TERMINAL DESIGNATIONS



JEDEC TO-39

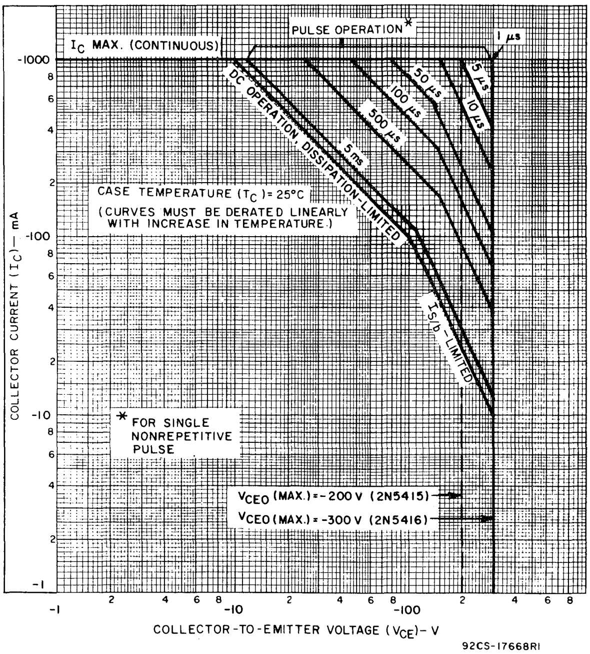


Fig. 1—Maximum safe operating areas for 2N5415 and 2N5416.

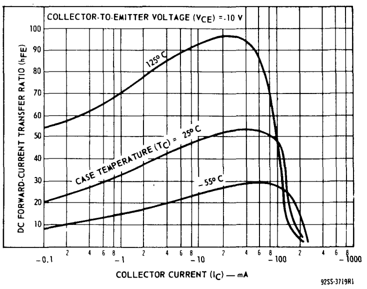


Fig. 2—Typical dc beta characteristics for all types.

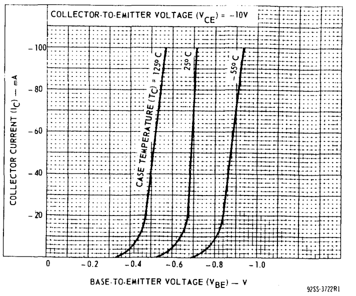


Fig. 3—Typical transfer characteristics for all types.

2N5415, 2N5416, RCS880-RCS882

ELECTRICAL CHARACTERISTICS, *Case Temperature (T_C) = 25°C*

CHARACTERISTIC SYMBOL	TEST CONDITIONS					LIMITS										UNITS
	VOLTAGE V dc			CURRENT mA dc		2N5415		2N5416		RCS880		RCS881		RCS882		
	V_{CB}	V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
I_{CEO}		−250			0	–	–	–	−50	–	–	–	–	–	−50	μA
		−150			0	–	−50	–	–	–	–	–	−50	–	–	
		−100			0	–	–	–	–	–	−50	–	–	–	–	
* I_{CBO}	−280					–	–	–	−50	–	–	–	–	–	−50	μA
	−175					–	−50	–	–	–	–	–	−50	–	–	
I_{CEV}		−300	1.5			–	–	–	−50	–	–	–	–	–	−50	μA
		−200	1.5			–	−50	–	–	–	–	–	−50	–	–	
		−150	1.5							–	−100	–	–	–	–	
* I_{EBO}			6	0		–	–	–	−20	–	–	–	–	–	−20	μA
			4	0		–	−20	–	–	–	−30	–	−20	–	–	
* h_{FE}		−10		-50^b		–	–	30	120	20	150	–	–	–	–	
		−10		-50^b		30	150	–	–	–	–	–	–	–	–	
		−10		-35^b		–	–	–	–	–	–	20	–	20	–	
V_{CEO}(sus)				−50	0	-200^a	–	-300^a	–	-150^a	–	-250^a	–	-300^a	–	V
V_{CER}(sus) (R_{BE}) = 50 Ω				−50		–	–	-350^a	–	–	–	–	–	-350^a	–	V
V_{BE}		−10		-50^b		–	−1.5	–	−1.5	–	−2.5	–	−1.5	–	−1.5	V
V_{CE}(sat)				-50^b	−5	–	−2.5	–	−2	–	−3.5	–	−3	–	−3	V
* h_{fe} (at 1 kHz)		−10		−5		25	–	25	–	–	–	–	–	–	–	
* $\|h_{fe}\|$ (at 5 MHz)		−10		−10		3	–	3	–	3	–	3	–	3	–	
* Re(h_{ie}) (at 1 MHz)		−10		−5		–	300	–	300	–	–	–	300	–	300	Ω
* C_{ib} (at 1 MHz)			5	0		–	75	–	75	–	–	–	75	–	75	pF
* C_{ob} (at 1 MHz)	−10					–	15	–	15	–	–	–	15	–	15	pF
$I_{S/b}$ t_p = 0.4 s nonrep.		−100				−100	–	−100	–	–	–	–	–	–	–	mA
		−75				–	–	–	–	–	–	−100	–	−100	–	
t_p = 0.2 s nonrep.		−75				–	–	–	–	−100	–	–	–	–	–	
$R\theta_{JC}$						–	17.5	–	17.5	–	23.3	–	23.3	–	23.3	°C/W

* 2N-Series types in accordance with JEDEC registration data format (JS-9 RDF-8).

[a] CAUTION: The sustaining voltages V_{CEO}(sus and V_{CER}(sus) MUST NOT be measured on a curve tracer.

[b] Pulsed: Pulse = 300 μs; duty factor ⩽2%.

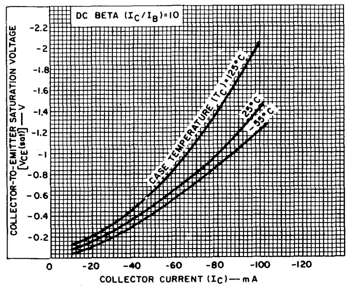


Fig. 4—Typical collector-to-emitter saturation voltage for all types.

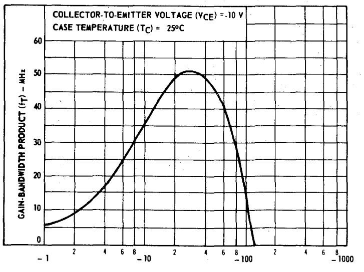


Fig. 5—Typical gain-bandwidth product for all types.

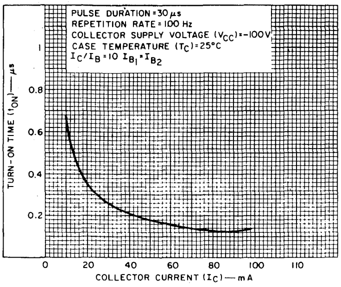


Fig. 6—Typical turn-on time characteristic for 2N5415 and 2N5416.

2N5415, 2N5416, RCS880-RCS882

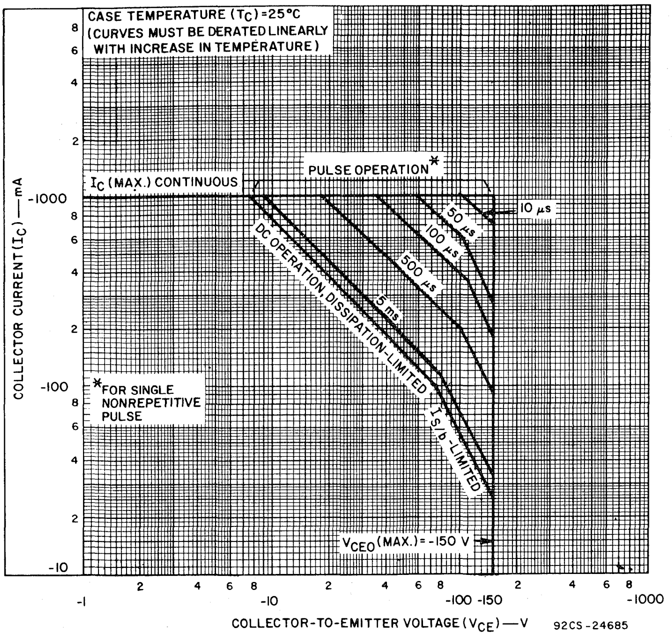


Fig. 7—Maximum safe operating areas for RCS880.

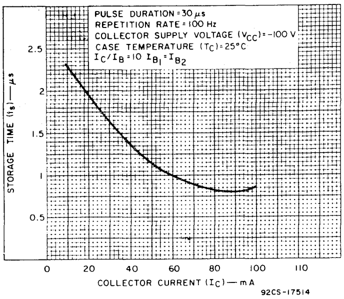


Fig. 8—Typical storage-time characteristic for 2N5415 and 2N5416.

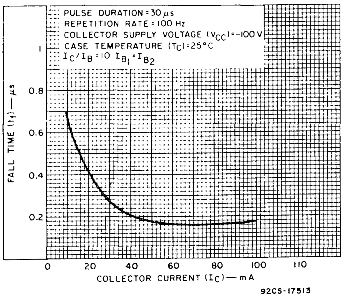


Fig. 10—Typical fall-time characteristic for 2N5415 and 2N5416

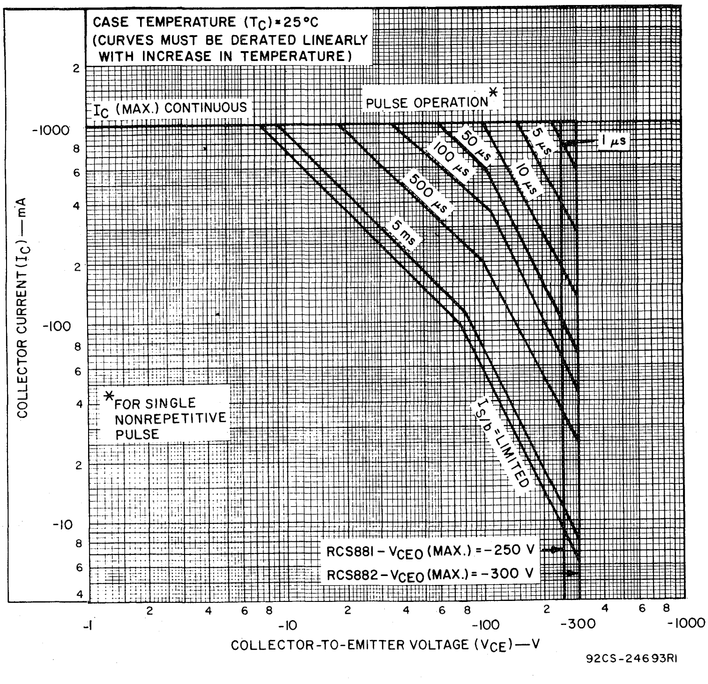


Fig. 9—Maximum safe operating areas for RCS881 and RCS882.

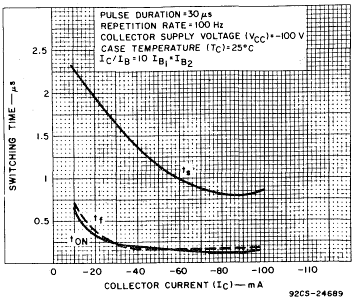


Fig. 11—Typical saturated switching times for RCS880, RCS881 and RCS882.

2N5490-2N5497

Hometaxial-Base, Silicon N-P-N VERSAWATT Transistors

General-Purpose Types for Medium-Power Switching and Amplifier Applications in Military, Industrial, and Commercial Equipment

RCA-2N5490, 2N5491, 2N5492, 2N5493, 2N5494, 2N5495, 2N5496 and 2N5497* are hometaxial-base silicon n-p-n transistors. They are intended for a wide variety of medium-power switching and amplifier applications, such as series and shunt regulators and driver and output stages of high-fidelity amplifiers.

Types 2N5491, 2N5493, 2N5495, and 2N5497 have formed emitter and base leads for insertion into TO-66 sockets. Types 2N5490, 2N5492, 2N5494, and 2N5496 are electrically identical to the 2N5491, 2N5493, 2N5495, and 2N5497 but have straight leads.

These new plastic power transistors differ in voltage ratings and in the currents at which the parameters are controlled.

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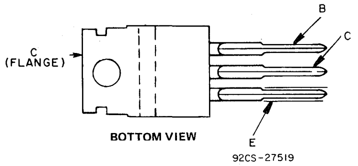
* Formerly RCA Dev. Nos. TA7317, TA7318, TA7315, TA7316, TA7313, TA7314, TA7311, TA7312, respectively.

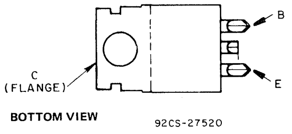
Features:

- **Low saturation voltage—**
  $V_{CE}(sat)$ = 1 V max. at I_C = 2 A (2N5490, 2N5491)
  = 1 V max. at I_C = 2.5 A (2N5492, 2N5493)
  = 1 V max. at I_C = 3 A (2N5494, 2N5495)
  = 1 V max. at I_C = 3.5 A (2N5496, 2N5497)
- **VERSAWATT package (molded silicone plastic)**
- **Maximum safe-area-of-operation curves**

TERMINAL DESIGNATIONS



JEDEC TO-220AB
2N5490, 2N5492, 2N5494, 2N5496



JEDEC TO-220AA
2N5491, 2N5493, 2N5495, 2N5497

Maximum Ratings, *Absolute-Maximum Values:*

		2N5490 2N5491 2N5494 2N5495	2N5492 2N5493	2N5496 2N5497	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	60	75	90	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:					
With -1.5 volts (V_{BE}) of reverse bias	$V_{CEV}(sus)$	60	75	90	V
With external base-to-emitter resistance (R_{BE}) = 100Ω	$V_{CER}(sus)$	50	65	80	V
With base open	$V_{CEO}(sus)$	40	55	70	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	5	5	V
COLLECTOR CURRENT	I_C	7	7	7	A
BASE CURRENT	I_B	3	3	3	A
TRANSISTOR DISSIPATION:	P_T				
At case temperatures up to 25°C		50	50	50	W
At ambient temperatures up to 25°C		1.8	1.8	1.8	W
At case temperatures above 25°C		Derate linearly at 0.4 W/°C or see Figs. 2 & 3.			
At ambient temperatures above 25°C		Derate linearly at 0.0144 W/°C			
TEMPERATURE RANGE:					
Storage & Operating (Junction)		← -65 to 150 →			°C
LEAD TEMPERATURE (During Soldering):					
At distance ≥ 1/8 in. (3.17 mm) from case for 10 s max		← 235 →			°C

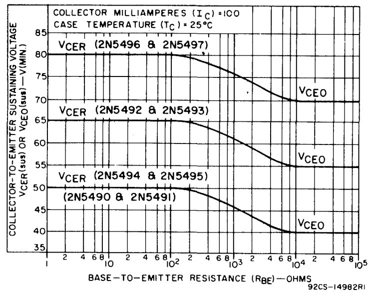


Fig. 1 Collector-to-emitter sustaining voltage characteristics for 2N5490 through 2N5497 inclusive.

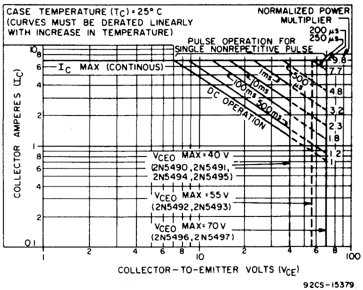


Fig. 2 - Maximum operating areas for 2N5490 through 2N5497 inclusive.

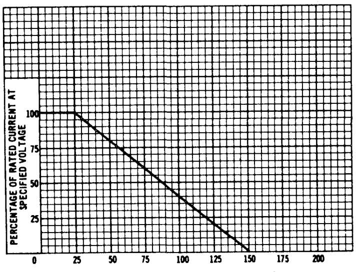


Fig. 3 - Derating curve for 2N5490 through 2N5497 inclusive.

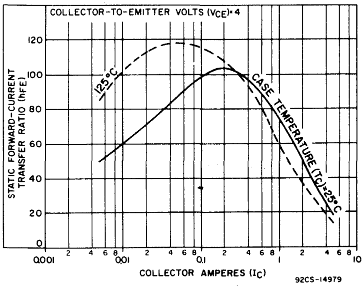


Fig. 4 - Typical static beta characteristics for 2N5496 and 2N5497.

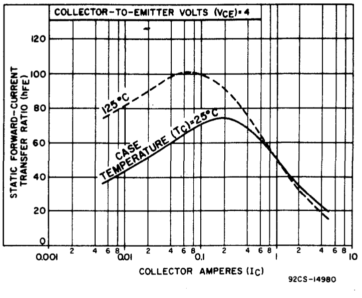


Fig. 5 - Typical static beta characteristics for 2N5494 and 2N5495.

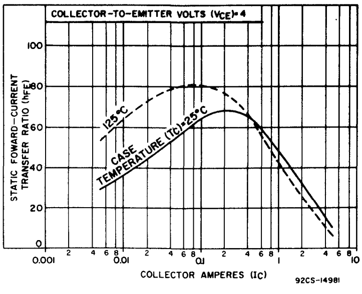


Fig. 6 - Typical static beta characteristics for 2N5490 through 2N5493 inclusive.

2N5490-2N5497

ELECTRICAL CHARACTERISTICS, *Case Temperature (T_C) = 25^{o}C Unless Otherwise Specified*

Characteristic	Symbol	TEST CONDITIONS				LIMITS								Units
		DC Voltage (V)		DC Current (A)		Types 2N5496 2N5497		Types 2N5494 2N5495		Types 2N5492 2N5493		Types 2N5490 2N5491		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Collector-Cutoff Current With base-emitter junction reverse biased	I_{CEV}	85	-1.5			-	1	-	-	-	-	-	-	mA
		55	-1.5			-	-	-	1	-	-	-	-	
		70	-1.5			-	-	-	-	-	1	-	-	
	I_{CEV} (T_C = 150^{o}C)	85	-1.5			-	5	-	-	-	-	-	-	mA
		55	-1.5			-	-	-	5	-	-	-	-	
		70	-1.5			-	-	-	-	-	5	-	-	
Collector-Cutoff Current With external base-to-emitter resistance (R_{BE}) = 100 Ω	I_{CER}	70				-	0.5	-	-	-	-	-	-	mA
		40				-	-	-	0.5	-	-	-	2	
		55				-	-	-	-	-	0.5	-	-	
	I_{CER} (T_C = 150oC)	70				-	3.5	-	-	-	-	-	-	mA
		40				-	-	-	3.5	-	-	-	5	
		55				-	-	-	-	-	3.5	-	-	
Emitter-Cutoff Current	I_{EBO}		-5			-	1	-	1	-	1	-	1	mA
DC Forward-Current Transfer Ratio	h_{FE}[c]	4		3.5		20	100	-	-	-	-	-	-	
		4		3		-	-	20	100	-	-	-	-	
		4		2.5		-	-	-	-	20	100	-	-	
		4		2		-	-	-	-	-	-	20	100	
Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$[c]			0.1	0	70	-	40	-	55	-	40	-	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	$V_{CER}(sus)$[c]			0.1		80	-	50	-	65	-	50	-	V
With base-emitter junction reverse biased	$V_{CEV}(sus)$[c]		-1.5	0.1		90	-	60	-	75	-	60	-	V
Base-to-Emitter Voltage	V_{BE}[c]	4		3.5		-	1.7	-	-	-	-	-	-	V
		4		3		-	-	-	1.5	-	-	-	-	
		4		2.5		-	-	-	-	-	1.3	-	-	
		4		2		-	-	-	-	-	-	-	1.1	
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$[c]			3.5	0.35	-	1	-	-	-	-	-	-	V
				3	0.3	-	-	-	1	-	-	-	-	
				2.5	0.25	-	-	-	-	-	1	-	-	
				2	0.2	-	-	-	-	-	-	-	1	
Gain-Bandwidth Product	f_T	4		0.5		0.8	-	0.8	-	0.8	-	0.8	-	MHz
Sat. Switching Time: Turn-On	t_{on}	V_{CC} = 30		3.5	0.35[a]	-	5	-	-	-	-	-	-	μs
				3	0.3[a]	-	-	-	5	-	-	-	-	
				2.5	0.25[a]	-	-	-	-	-	5	-	-	
				2	0.2	-	-	-	-	-	-	-	5	
Turn-Off	t_{off}	V_{CC} = 30		3.5	0.35[b]	-	15	-	-	-	-	-	-	μs
				3	0.3[b]	-	-	-	15	-	-	-	-	
				2.5	0.25[b]	-	-	-	-	-	15	-	-	
				2	0.2	-	-	-	-	-	-	-	15	
Thermal Resistance: Junction-to-Case	θ_{J-C}					-	2.5	-	2.5	-	2.5	-	2.5	^{o}C/W
Junction-to-Ambient	θ_{J-A}					-	70	-	70	-	70	-	70	^{o}C/W

[a] I_{B1} value (turn-on base current). [b] I_{B2} value (turn-off base current). [c] Pulsed, pulse duration = 300 μs, duty factor = .018.

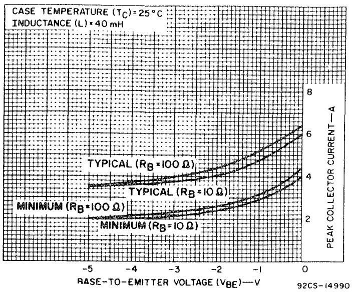


Fig. 7 - Reverse-bias, second-breakdown characteristics for 2N5490 through 2N5497 inclusive.

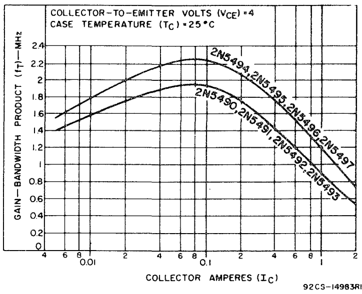


Fig. 8 - Typical gain-bandwidth product for 2N5490 through 2N5497 inclusive.

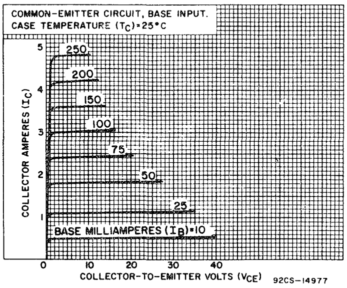


Fig. 9 - Typical output characteristics for 2N5494 through 2N5497 inclusive.

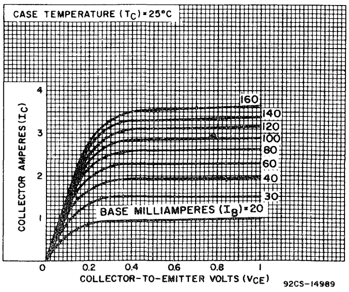


Fig. 10 - Typical output characteristics for 2N5494 and 2N5495.

2N5490-2N5497

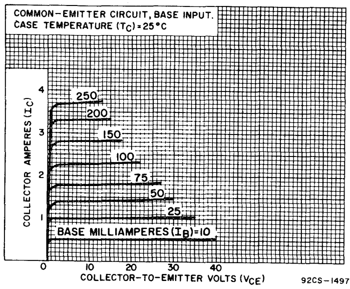


Fig. 11 - Typical output characteristics for 2N5490 through 2N5493 inclusive.

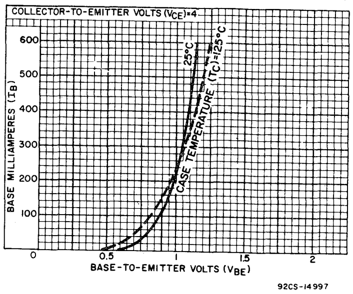


Fig. 12 - Typical input characteristics for 2N5494 through 2N5497 inclusive.

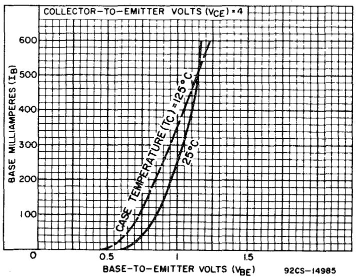


Fig. 13 - Typical input characteristics for 2N5490 through 2N5493 inclusive.

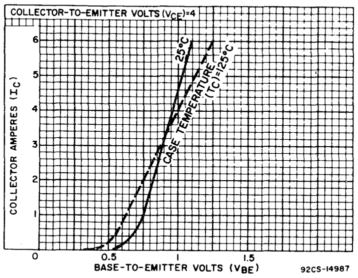


Fig. 14 - Typical transfer characteristics for 2N5494 through 2N5497 inclusive.

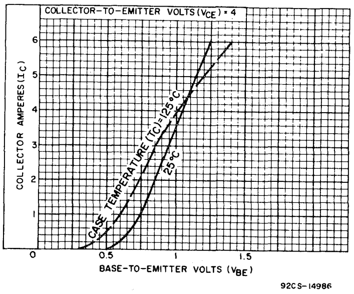


Fig. 15 - Typical transfer characteristics for 2N5490 through 2N5493 inclusive.

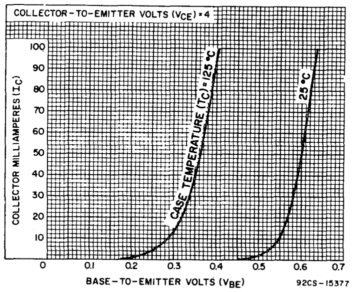


Fig. 16 - Typical transfer characteristics for 2N5490 through 2N5497 inclusive.

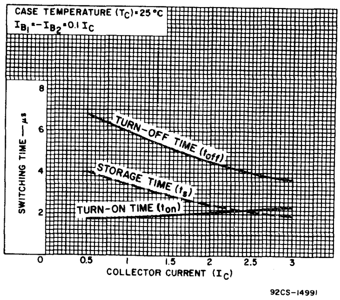


Fig. 17 - Typical saturated switching characteristics for 2N5494 and 2N5495.

2N5575, 2N5578

High-Current, High-Power, Hometaxial-Base Silicon N-P-N Transistors

For Linear and Switching Applications in
Military, Commercial, and Industrial Equipment

RCA-2N5575 and 2N5578● are high-current, high-power, hometaxial-base silicon n-p-n transistors. They differ in maximum voltage and current ratings.

These power transistors are intended for a wide variety of high-current, high-power linear and switching applications such as low- to medium-frequency amplifiers, switching and linear regulators, power-switching circuits, series- or shunt-regulator driver and output stages, dc-to-dc converters, inverters, control circuits, and solenoid (hammer)/relay drivers.

The high-current capability (100-A peak) makes these types particularly suitable for circuit designs that now require several low-current types connected in parallel.

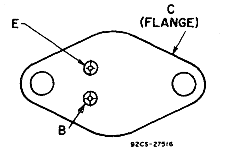
They are supplied in the Modified JEDEC TO-3 package with 0.060-In. Dia. Pins.

● Formerly RCA Dev. Nos. TA7016 and TA7017, respectively.

Features:

- Maximum safe-area-of operation curves
- $I_{S/b}$-limit line beginning at 25 V
- High-current capability
- Low saturation voltage at high beta
- High-dissipation capability
- Low thermal resistance

TERMINAL DESIGNATIONS



Modified JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		2N5575	2N5578	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	70	90	V
*COLLECTOR-TO-EMITTER VOLTAGE:				
With base open, sustaining	$V_{CEO}(sus)$	50	70	V
With external base-to-emitter resistance (R_{BE}) = 10 Ω & V_{BE} = −1.5 V	V_{CEX}	70	90	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	8	8	V
*COLLECTOR CURRENT (Continuous)	I_C	80	60	A
*COLLECTOR CURRENT (Peak)		100	80	A
*BASE CURRENT (Continuous)	I_B	20	15	A
*TRANSISTOR DISSIPATION:	P_T			
At case temperatures up to 25°C and V_{CE} up to 25 V		300	300	W
At case temperatures of 100°C and V_{CB} of 25 V		150	150	W
At case temperatures up to 25°C and V_{CE} above 25 V		See Fig. 5		
At case temperatures above 25°C and V_{CE} above 25 V		See Figs. 1 & 5		
*TEMPERATURE RANGE:				
Operating (Junction)		−65 to 175		°C
Storage		−65 to 200		°C
*PIN TEMPERATURE (During Soldering):				
At distance ≥ 1/32 in. (0.8 mm) from case for 10 s max.		230		°C

* In accordance with JEDEC registration data format JS-6 RDF-1

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS				UNITS
		Voltage V dc		Current A dc		2N5575		2N5578		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
Collector Cutoff Current:										
* With base-emitter junction reverse-biased	I_{CEV}	60	−1.5			–	10	–	–	mA
		80	−1.5			–	–	–	10	
With external base-emitter resistance (R_{BE})=10 Ω	I_{CER}	50				–	10	–	–	mA
		70				–	–	–	10	
* With base-emitter junction reverse-biased	I_{CEV} (T_C=150°C)	60	−1.5			–	20	–	–	mA
		80	−1.5			–	–	–	20	
* Emitter Cutoff Current	I_{EBO}		−8			–	10	–	10	mA
* Collector-to-Emitter Breakdown Voltage	$V_{(BR)CEO}$			0.2	0	50	–	70	–	
* DC Forward Current Transfer Ratio	$h_{FE}{}^a$	3		40^a		–	–	10	40	
		4		60^a		10	40	–	–	
Collector-to-Emitter Sustaining Voltage: (See Figs. 5 and 6) With base open	$V_{CEO}(sus)$			0.2		50^b	–	70^b	–	V
With base-emitter junction reverse-biased, R_{BE}=10 Ω	$V_{CEX}(sus)$		−1.5	7		70^b	–	90^b	–	V
Base-to-Emitter Voltage	$V_{BE}{}^a$	4		40^a		–	–	–	2.5	V
		4		60^a		–	3	–	–	
* Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)^a$			40^a	4	–	–	–	1.5	V
				60^a	6	–	2	–	–	
* Base-to-Emitter Saturation Voltage	$V_{BE}(sat)^a$			40^a	4	–	–	–	2.5	V
				60^a	6	–	3	–	–	
Output Capacitance: (V_{CB} = 10 V)	C_{ob}					–	2000	–	2000	pF
Input Capacitance	C_{ib}		−0.5	0		–	4000	–	4000	pF
* Magnitude of Common-Emitter, Small-Signal, Short-Circuit Forward Current Transfer Ratio (f=0.2 MHz)	$\|h_{fe}\|$	4		10		2	–	2	–	

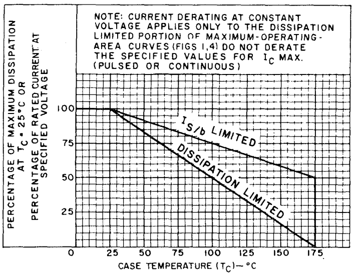


Fig. 1 - Dissipation derating curves for both types.

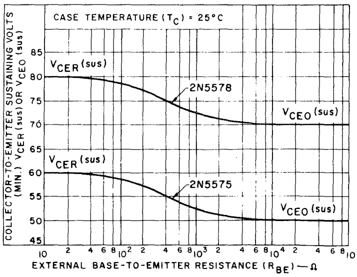


Fig. 2 - Collector-to-emitter sustaining voltage characteristics for both types.

2N5575, 2N5578

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified (Cont'd.)*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS				UNITS
		Voltage V dc		Current A dc		2N5575		2N5578		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
* Saturated Switching Time (V_{CC} = 30 V): Turn-on time	t_{ON}			40	4	–	–	–	10	μs
				60	6	–	15	–	–	
Turn-off time	t_{OFF}			40	4	–	–	–	10	
				60	6	–	15	–	–	
Forward-Bias Second-Breakdown Collector Current (t = 1 s)	$I_{S/b}$	25				12	–	12	–	A
Second Breakdown Energy (With base reverse-biased, R_{BE} 10 Ω, L 33 mH)	$E_{S/b}$		1.5	7		0.8	–	0.8	–	J
Thermal Resistance: (Junction-to-Case)	$R_{\theta JC}$					–	0.5	–	0.5	°C/W

[a] Pulsed; pulse duration ≤ 350 μs, duty factor=0.02.

[b] CAUTION: The sustaining voltages V_{CEO}(sus) and V_{CEX}(sus) MUST NOT be measured on a curve tracer. These sustaining voltages should be measured by means of the test circuit shown in Fig. 5.

*In accordance with JEDEC registration data format JS-6 RDF-1.

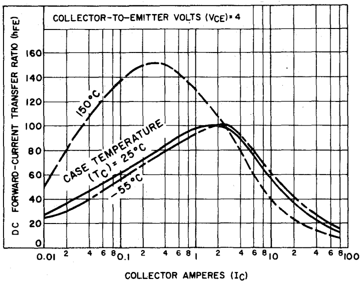


Fig. 3 - Typical dc beta characteristics for 2N5575.

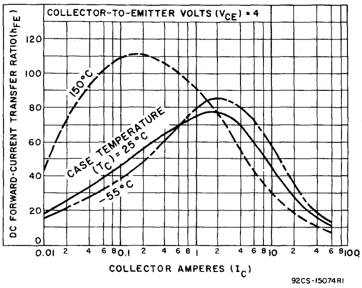


Fig. 4 - Typical dc beta characteristics for 2N5578.

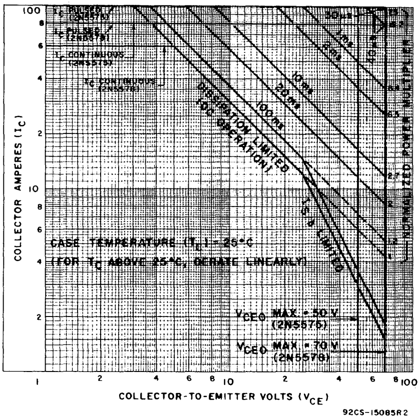


Fig. 5 - Maximum operating areas for both types.

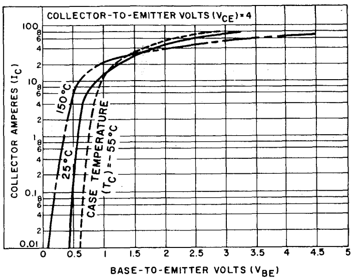


Fig. 6 - Typical transfer characteristics for 2N5575.

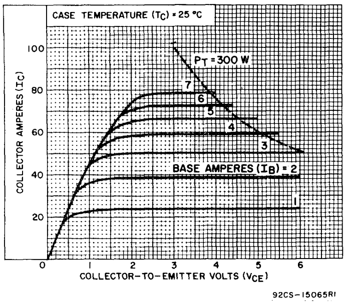


Fig. 7 - Typical output characteristics for 2N5575.

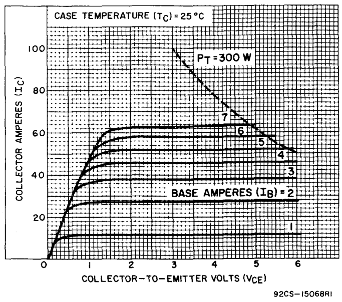


Fig. 8 - Typical output characteristics for 2N5578.

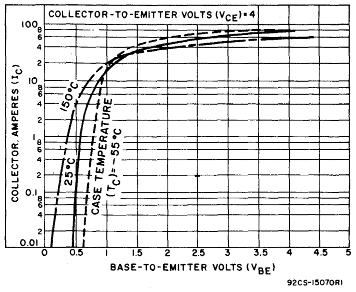


Fig. 9 - Typical transfer characteristics for 2N5578.

2N5575, 2N5578

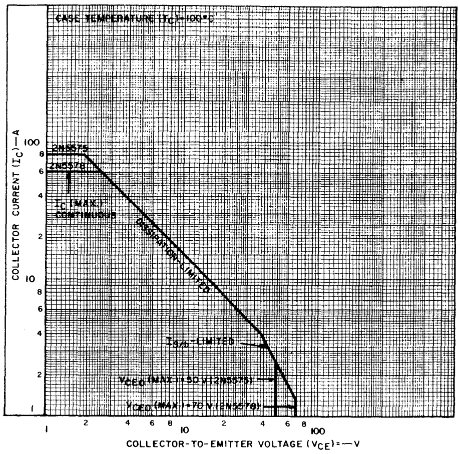


Fig. 10 - Maximum operating areas for both types at $T_C = 100^oC$.

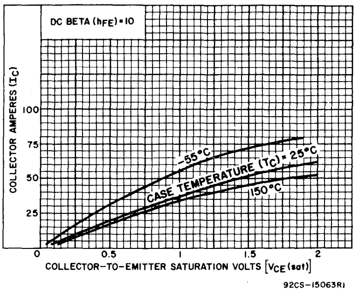


Fig. 11 - Typical saturation voltage characteristics for 2N5575.

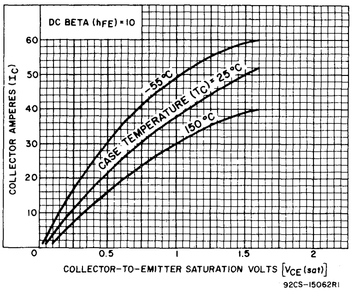


Fig. 12 - Typical saturation voltage characteristics for 2N5578.

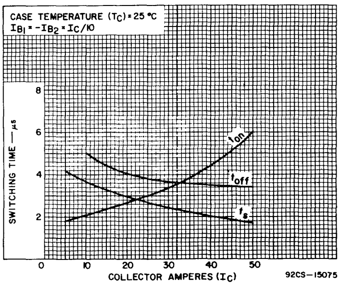


Fig. 13 - Typical saturated switching characteristics for both types.

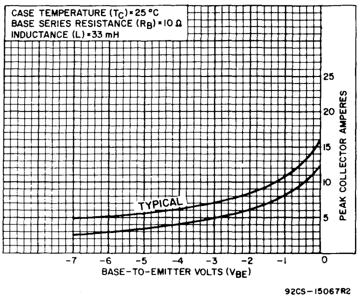


Fig. 14 - Reverse-bias second-breakdown characteristics for both types.

2N5671, 2N5672

SILICON N-P-N POWER TRANSISTORS

High-Current, High-Speed, High-Power Types for Switching and Amplifier Applications

RCA Types 2N5671 and 2N5672▲ are epitaxial silicon n-p-n transistors having high current and high power handling capability and fast switching speed. The 2N5672 is similar to the 2N5671 except that it has higher voltage ratings and lower leakage currents. These devices are especially suitable for switching-control amplifiers, power gates, switching regulators, power-switching circuits, converters, inverters, control circuits. Other recommended applications included DC-RF amplifiers and power oscillators.

They are supplied in the JEDEC TO-3 hermetic steel package.

▲Formerly Dev. Types TA7323 and TA7323A, respectively

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	2N5671	2N5672	
*COLLECTOR-TO-BASE VOLTAGE, V_{CBO}	120	150	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:			
With base open, $V_{CEO}(sus)$	90	120	V
With external base-to-emitter resistance (R_{BE}) ≤ 50 Ω, $V_{CER}(sus)$	110	140	V
With external base-to-emitter resistance (R_{BE}) ≤ 50 Ω & V_{BE} = -1.5, $V_{CEX}(sus)$	120	150	V
*EMITTER-TO-BASE VOLTAGE, V_{EBO}	7	7	V
*COLLECTOR CURRENT, I_C	30	30	A
*BASE CURRENT, I_B	10	10	A
*TRANSISTOR DISSIPATION, P_T:			
At case temperatures up to 25° C and V_{CE} up to 24 V	140	140	W
At case temperatures up to 25° C and V_{CE} above 24 V	See Fig. 1		
At case temperatures above 25° C and V_{CE} above 24 V	See Figs.1&2.		
*TEMPERATURE RANGE:			
Storage & Operating (Junction)	-65 to +200		°C
*PIN TEMPERATURE (During Soldering)			
At distances ≥ 1/32 in. from seating plane for 10 s max	230		°C

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*In accordance with JEDEC registration data format (JS-6, RFD-1)

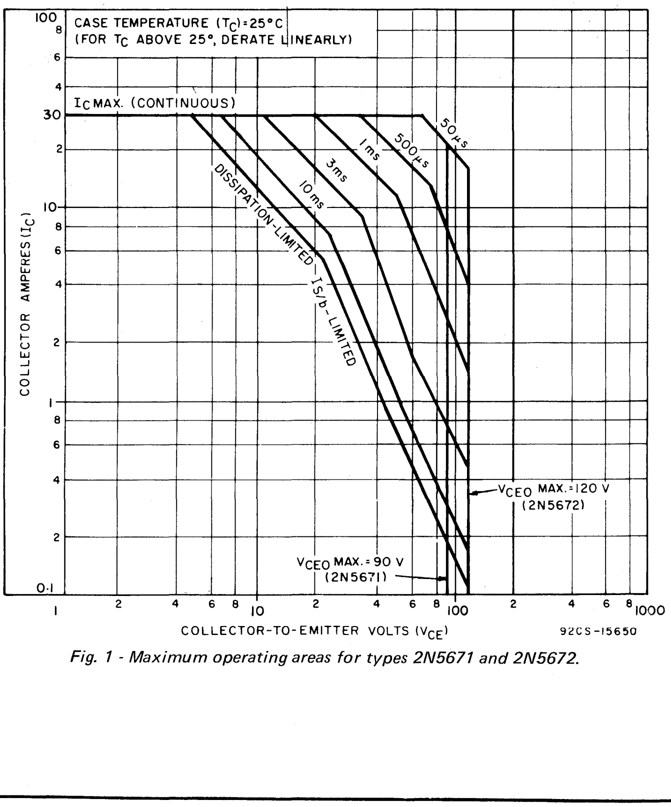
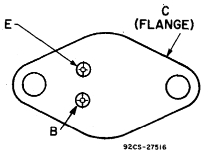


Fig. 1 - Maximum operating areas for types 2N5671 and 2N5672.

Features:

- **Maximum Safe-Area-of-Operation Curves . . . $I_{S/b}$ limit line beginning at 24 V**
- **Fast Turn-On Time . . . t_{on} = 0.5μs max. at I_C = 15 A**
- **High-Current Capability . . . h_{FE}, $V_{CE}(sat)$, $V_{BE}(sat)$, & V_{BE} measured at I_C = 15 A**
- **Low $V_{CE}(sat)$ = 0.75 V max.**
- **High P_T = 140 W max. at T_C = 25° C**

TERMINAL DESIGNATIONS



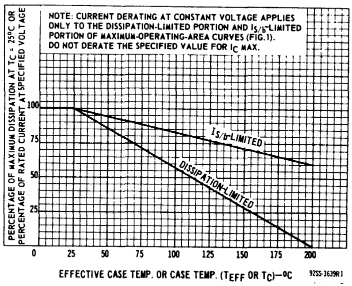


Fig. 2 - Dissipation derating curves for types 2N5671 and 2N5672.

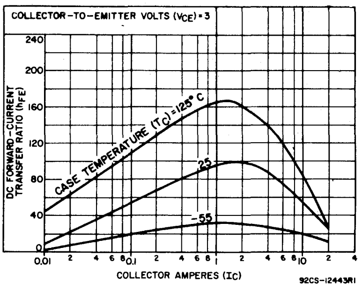


Fig. 3 - Typical dc beta characteristics for types 2N5671 and 2N5672.

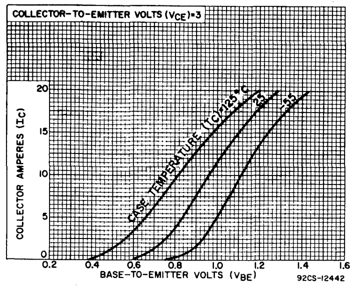


Fig. 4 - Typical transfer characteristics for types 2N5671 and 2N5672.

2N5671, 2N5672

ELECTRICAL CHARACTERISTICS, *Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS					LIMITS				UNITS
		DC Voltage (V)			DC Current (A)		Type 2N5671		Type 2N5672		
		V_{CB}	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
Collector-Cutoff Current	I_{CEO}	–	80	–	–	0	–	10	–	10	mA
*	I_{CEV}	–	110 135	-1.5 -1.5	– —	– —	– —	12 —	– —	— 10	mA mA
*	I_{CEV} (T_C=150° C)	–	100	-1.5	–	–	–	15	–	10	mA
* Emitter-Cutoff Current	I_{EBO}	–	–	-7	0	–	–	10	–	10	mA
Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$	–	–	–	0.2	0	90[a]	–	120[a]	–	V
With external base-to-emitter resistance (R_{BE}) ≤50 Ω	$V_{CER}(sus)$	–	–	–	0.2	0	110[a]	–	140[a]	–	V
With base-emitter junction reverse biased & R_{BE} ≤ 50 Ω	$V_{CEX}(sus)$	–	–	-1.5	0.2	–	120[a]	–	150[a]	–	V
* Base-to-Emitter Saturation Voltage	$V_{BE}(sat)$	–	–	–	15	1.2	–	1.5	–	1.5	V
Base-to-Emitter Voltage	V_{BE}	–	5	–	15	–	–	1.6	–	1.6	V
* Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$	–	–	–	15	1.2	–	0.75	–	0.75	V
* DC Forward-Current Transfer Ratio	h_{FE}	– –	2 5	– –	15 20	– –	20 20	100 –	20 20	100 –	
Second-Breakdown Collector Current [c] With base forward biased	$I_{S/b}$[b]	– –	24 45	– –	– —	– –	5.8[c] 0.9[c]	– –	5.8[c] 0.9[c]	– –	A A
Second-Breakdown Energy With base reverse biased R_{BE} = 20 Ω, L = 180 μH	$E_{S/b}$[d]	–	–	-4	15	–	20	–	20	–	mJ
Gain-Bandwidth Product	f_T	–	10	–	2	–	50	–	50	–	MHz
Output Capacitance (At 1 MHz, I_E= 0)	C_{ob}	10	–	–	–	–	–	900	–	900	pF
* Saturated Switching Turn-On Time (Delay Time + Rise Time)	t_{on}	V_{CC}= 30 V	–	–	15	I_{B_1}= I_{B_2}= 1.2	–	0.5	–	0.5	μs
* Saturated Switching Storage Time	t_s	V_{CC}= 30 V	–	–	15	I_{B_1}= I_{B_2}= 1.2	–	1.5	–	1.5	μs
* Saturated Switching Fall Time	t_f	V_{CC}= 30 V	–	–	15	I_{B_1}= I_{B_2}= 1.2	–	0.5	–	0.5	μs
Thermal Resistance (Junction-to-Case)	$R_{\theta JC}$	–	10	–	5	–	–	1.25	–	1.25	°C/W

[a] Pulsed; pulse duration ≤ 350 μs, duty factor=0.02.

[b] CAUTION: The sustaining voltages $V_{CEO}(sus)$ and $V_{CEX}(sus)$ MUST NOT be measured on a curve tracer. These sustaining voltages should be measured by means of the test circuit shown in Fig. 5.

[c] $I_{S/b}$ is defined as the current at which second breakdown occurs at a specified collector voltage with the emitter-base junction forward-biased for transistor operation in the active region.

[d] Pulsed; 1-s, non-repetitive pulse.

[e] $E_{S/b}$ is defined as the energy at which second breakdown occurs under specified reverse-bias conditions. $E_{S/b}=1/2LI^2$ where L is a series load or leakage inductance and I is the peak collector current.

*In accordance with JEDEC registration data format JS-6 RDF-1.

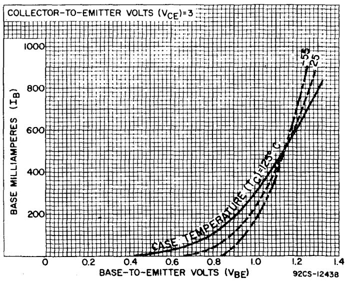


Fig. 5 - Typical input characteristics for types 2N5671 and 2N5672.

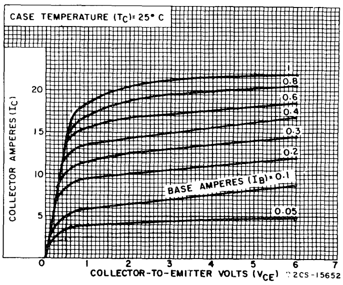


Fig. 6 - Typical output characteristics for types 2N5671 and 2N5672.

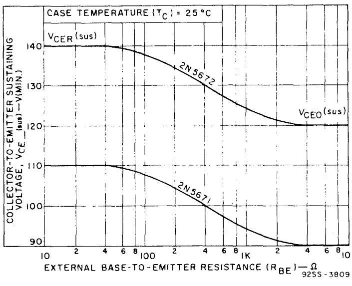


Fig. 7 - Collector-to-emitter sustaining voltage characteristics for types 2N5671 and 2N5672.

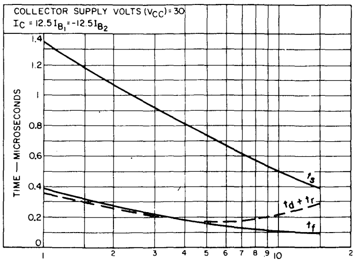


Fig. 8 - Typical saturated switching characteristics for types 2N5671 and 2N5672.

2N5781-2N5786

Silicon N-P-N and P-N-P Epitaxial-Base Complementary-Symmetry Transistors

General-Purpose Types for Switching and Linear-Amplifier Applications

RCA-2N5781, 2N5782, and 2N5783 are epitaxial-base silicon p-n-p transistors - - complements of the hometaxial-base silicon n-p-n types 2N5784, 2N5785, and 2N5786,● respectively.

The three types in each family differ primarily in voltage ratings and saturation characteristics.

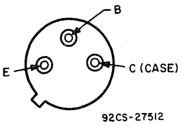
These transistors are intended for medium-power switching and complementary-symmetry audio amplifier applications.

● Formerly RCA Dev. Types TA7270, TA7271, TA7272, TA7289, TA7290, and TA7291 respectively.

Features:

- Low saturation voltages
- Maximum safe-area-of-operation curves
- Hermetically sealed package
- High gain at high current
- High breakdown voltages

TERMINAL DESIGNATIONS



JEDEC TO-5 or TO-39

These devices are available with either 1½-inch leads (TO-5 package) or ½-inch leads (TO-39 package). The longer-lead versions are specified by suffix "L" after the type number; the shorter-lead versions are specified by suffix "S" after the type number.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		P-N-P: 2N5781◆ N-P-N: 2N5784	2N5782◆ 2N5785	2N5783◆ 2N5786	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	80	65	45	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:					
* With external base-to-emitter resistance (R_{BE}) = 100 Ω	$V_{CER}(sus)$	80	65	45	V
With base open	$V_{CEO}(sus)$	65	50	40	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	5	3.5	V
*CONTINUOUS COLLECTOR CURRENT	I_C	3.5	3.5	3.5	A
*CONTINUOUS BASE CURRENT	I_B	1	1	1	A
*TRANSISTOR DISSIPATION:	P_T				
At case temperatures up to 25°C		10	10	10	W
At ambient temperatures up to 25°C		1	1	1	W
At case temperatures above 25°C ... Derate linearly		0.057 W/°C, or see Fig. 1			
At ambient temperatures above 25°C ... Derate linearly		0.0057			W/°C
*TEMPERATURE RANGE:					
Storage and operating (Junction)		−65 to +200			°C
*LEAD TEMPERATURE (During soldering):					
At distance ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max.		230			°C

*In accordance with JEDEC registration data format JS-6 RDF-2.

◆For p-n-p devices, voltage and current values are negative.

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS◆ VOLTAGE V dc: V_{CE}	V_{BE}	CURRENT A dc: I_C	I_B	LIMITS 2N5781 p-n-p: Min.	Max.	2N5784 n-p-n: Min.	Max.	UNITS
Collector Cutoff Current: With external base-to-emitter resistance (R_{BE}) = 100 Ω	I_{CER}	65				–	−10	–	10	μA
At T_C = 150°C		65				–	−1	–	1	mA
* With base-emitter junction reverse-biased and external base-to-emitter resistance (R_{BE}) = 100 Ω	I_{CEX}	−75 75	1.5 −1.5			– –	−10 –	– –	– 10	μA
* At T_C = 150°C		−75 75	1.5 −1.5			– –	−1 –	– –	– 1	mA
* With base open	I_{CEO}	60			0	–	−100	–	100	μA
* Emitter Cutoff Current	I_{EBO}		−5	0		–	−10	–	10	μA
* DC Forward-Current Transfer Ratio	h_{FE}	2 2		1^a 3.2^a		20 4	100 –	20 4	100 –	
* Collector-to-Emitter Sustaining Voltage (see Figs, 2 and 3): With base open	$V_{CEO}(sus)$			0.1^a	0	-65^b	–	65^b	–	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	$V_{CER}(sus)$			0.1^a		-80^b	–	80^b	–	
* Base-to-Emitter Voltage	V_{BE}	2		1^a		–	−1.5	–	1.5	V
* Collector-to-Emitter Saturation Voltage (measured 0.25 in (6.35 mm) from case)[c]	$V_{CE}(sat)$			1^a	0.1	–	−0.5	–	0.5	V
* Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio[d] f = 4 MHz	$\|h_{fe}\|$	−2		−0.1		2	15	–	–	
f = 200 kHz		2		0.1				5	20	
* Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f = 1 kHz)	h_{fe}	2		0.1		25	–	25	–	

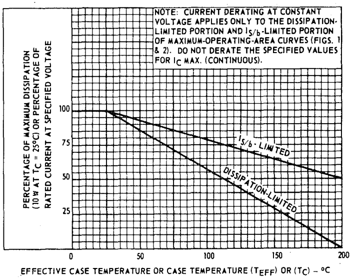


Fig. 1 - Dissipation derating curve for all types.

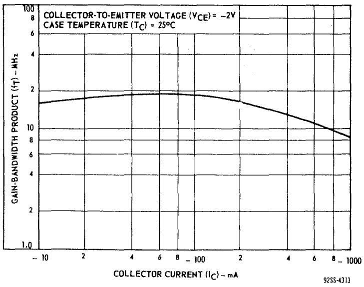


Fig. 2 - Typical gain-bandwidth product for 2N5781, 2N5782, & 2N5783.

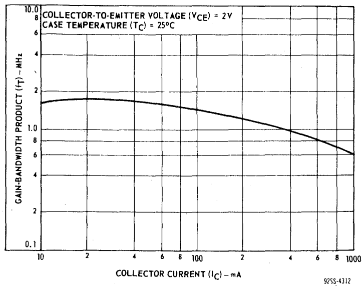


Fig. 3 - Typical gain-bandwidth product for 2N5784, 2N5785, & 2N5786.

2N5781-2N5786

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS◆				LIMITS				UNITS
		VOLTAGE V dc		CURRENT A dc		2N5781 p-n-p		2N5784 n-p-n		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
Saturated Switching Time (V_{CC} = 30 V, $I_{B1} = I_{B2}$): Turn-on ($t_d + t_r$)	t_{ON}			–1 1	–0.1 0.1	– –	0.5 –	– –	– 5	μs
Turn-off ($t_s + t_f$)	t_{OFF}			–1 1	–0.1 0.1	– –	2.5 –	– –	– 15	
Thermal Resistance: Junction-to-case	$R_{\theta JC}$					–	17.5	–	17.5	°C/W
Junction-to-ambient	$R_{\theta JA}$					–	175	–	175	

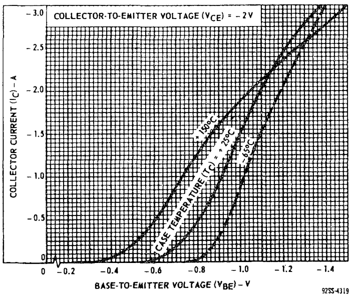


Fig. 4 - Typical transfer characteristics for types 2N5781, 2N5782, 2N5783.

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS◆				LIMITS				UNITS
		VOLTAGE V dc		CURRENT A dc		2N5782 p-n-p		2N5785 n-p-n		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
Collector Cutoff Current: With external base-to-emitter resistance (R_{BE}) = 100 Ω	I_{CER}	50				–	–10	–	10	μA
At T_C = 150°C		50				–	–1	–	1	mA
* With base-emitter junction reverse-biased and external base-to-emitter resistance (R_{BE}) = 100 Ω	I_{CEX}	–60 60	1.5 –1.5			– –	–10 –	– –	– 10	μA
* At T_C = 150°C		–60 60	1.5 –1.5			– –	–1 –	– –	– 1	mA
* With base open	I_{CEO}	35			0	–	–100	–	100	μA
* Emitter Cutoff Current	I_{EBO}		–5	0		–	–10	–	10	μA
* DC Forward-Current Transfer Ratio	h_{FE}	2 2		1.2^a 3.2^a		20 4	100 –	20 4	100 –	
* Collector-to-Emitter Sustaining Voltage (see Figs. 2 and 3): With base open	$V_{CEO}(sus)$			0.1^a	0	-50^b	–	50^b	–	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	$V_{CER}(sus)$			0.1^a		-65^b	–	65^b	–	
* Base-to-Emitter Voltage	V_{BE}	2		1.2^a		–	–1.5	–	1.5	V
* Collector-to-Emitter Saturation Voltage (measured 0.25 in (6.35 mm) from case)[c]	$V_{CE}(sat)$			1.2^a 3.2^a	0.12 0.8	– –	–0.75 –2	– –	0.75 2	V
* Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio[d] f = 4 MHz	$\|h_{fe}\|$	–2		–0.1		2	15	–	–	
f = 200 kHz		2		0.1		–	–	5	20	
* Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f = 1 kHz)	h_{fe}	2		0.1		25	–	25	–	
Saturated Switching Time (V_{CC} = 30 V, $I_{B1} = I_{B2}$): Turn-on ($t_d + t_r$)	t_{ON}			–1 1	–0.1 0.1	– –	0.5 –	– –	– 5	μs
Turn-off ($t_s + t_f$)	t_{OFF}			–1 1	–0.1 0.1	– –	2.5 –	– –	– 15	
Thermal Resistance: Junction-to-case	$R_{\theta JC}$						17.5	–	17.5	°C/W
Junction-to-ambient	$R_{\theta JA}$					–	175	–	175	

* In accordance with JEDEC registration data format JS-6 RDF-2.

[a] Pulsed, pulse duration = 300 μs, duty factor = 1.8%.

[b] *CAUTION: Sustaining voltages $V_{CEO}(sus)$, and $V_{CER}(sus)$ MUST NOT be measured on a curve tracer.*

◆ For p-n-p devices, voltage and current values are negative.

[c] Lead resistance is critical in this test.

[d] Measured at a frequency where $|h_{fe}|$ is decreasing at approximately 6 dB per octave.

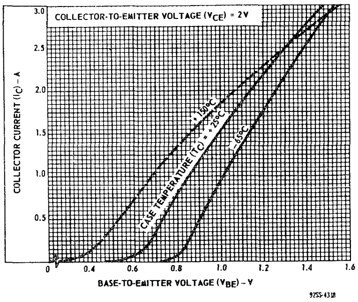


Fig. 5 - Typical transfer characteristics for types 2N5784, 2N5785, 2N5786.

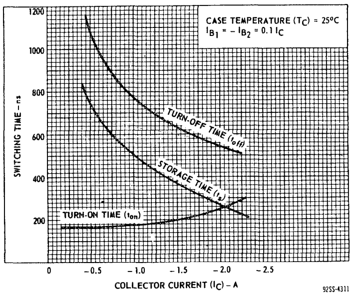


Fig. 6 - Typical saturated switching characteristics for types 2N5781, 2N5782, 2N5783.

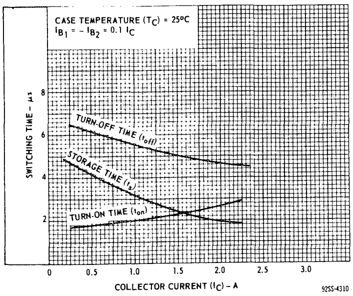


Fig. 7 - Typical saturated switching characteristics for types 2N5784, 2N5785, & 2N5786.

2N5781-2N5786

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS♦				LIMITS				UNITS
		VOLTAGE V dc		CURRENT A dc		2N5783 p-n-p		2N5786 n-p-n		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
Collector Cutoff Current: With external base-to-emitter resistance (R_{BE}) = 100 Ω	I_{CER}	40				–	–10	–	10	μA
At T_C = 150°C		40.				–	–1	–	1	mA
* With base-emitter junction reverse-biased and external base-to-emitter resistance (R_{BE}) = 100 Ω	I_{CEX}	–45 45	1.5 –1.5			– –	–10 –	– –	– 10	μA
* At T_C = 150°C		–45 45	1.5 –1.5			– –	–1 –	– –	– 1	mA
* With base open	I_{CEO}	25			0	–	–100	–	100	μA
* Emitter Cutoff Current	I_{EBO}		–3.5	0		–	–10	–	10	μA
* DC Forward-Current Transfer Ratio	h_{FE}	2 2		1.6^a 3.2^a		20 4	100 –	20 4	100 –	
* Collector-to-Emitter Sustaining Voltage (see Figs. 2 and 3): With base open	$V_{CEO}(sus)$			0.1^a	0	-40^b	–	40^b	–	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	$V_{CER}(sus)$			0.1^a		-45^b	–	45^b	–	
* Base-to-Emitter Voltage	V_{BE}	2		1.6^a		–	–1.5	–	1.5	V
* Collector-to-Emitter Saturation Voltage (measured 0.25 in (6.35 mm) from case)[c]	$V_{CE}(sat)$			1.6^a 3.2^a	0.16 0.8	– –	–1 –2	– –	1 2	V
* Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio[d] f = 4 MHz	$\|h_{fe}\|$	–2		–0.1		2	15	–	–	
f = 200 kHz		2		0.1		–	–	5	20	
* Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f = 1 kHz)	h_{fe}	2		0.1		25	–	25	–	
Saturated Switching Time (V_{CC} = 30 V, $I_{B1} = I_{B2}$): Turn-on ($t_d + t_r$)	t_{ON}			–1 1	–0.1 0.1	– –	0.5 –	– –	– 5	μs
Turn-off ($t_s + t_f$)	t_{OFF}			–1 1	–0.1 0.1	– –	2.5 –	– –	– 15	
Thermal Resistance: Junction-to-case	$R_{\theta JC}$						17.5	–	17.5	°C/W
Junction-to-ambient	$R_{\theta JA}$					–	175	–	175	

* In accordance with JEDEC registration data format JS-6 RDF-2.

[a] Pulsed, pulse duration = 300 μs, duty factor = 1.8%.

[b] *CAUTION: Sustaining voltages $V_{CEO}(sus)$, and $V_{CER}(sus)$ MUST NOT be measured on a curve tracer.*

♦ For p-n-p devices, voltage and current values are negative.

[c] Lead resistance is critical in this test.

[d] Measured at a frequency where $|h_{fe}|$ is decreasing at approximately 6 dB per octave.

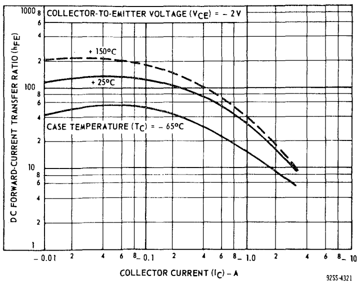


Fig. 8 - Typical dc-beta characteristics for type 2N5781.

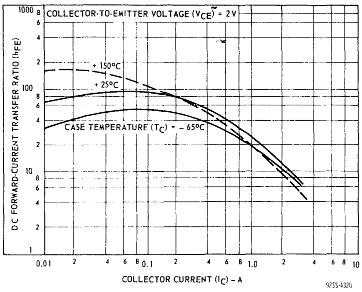


Fig. 9 - Typical dc-beta characteristics for type 2N5784.

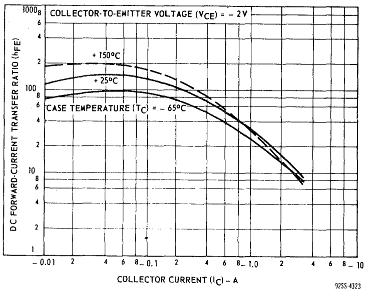


Fig. 10 - Typical dc-beta characteristics for type 2N5782.

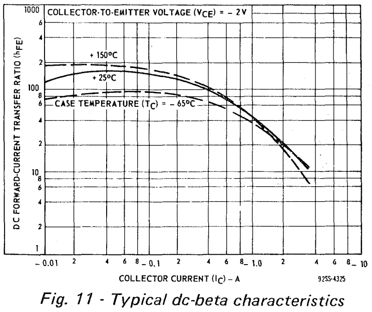


Fig. 11 - Typical dc-beta characteristics for type 2N5783.

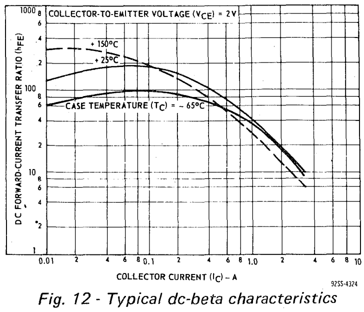


Fig. 12 - Typical dc-beta characteristics for type 2N5786.

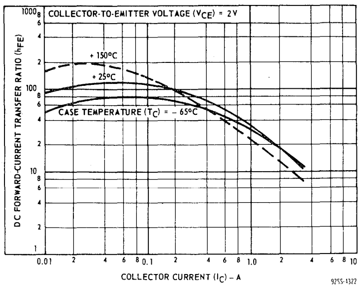


Fig. 13 - Typical dc-beta characteristics for type 2N5785.

2N5781-2N5786

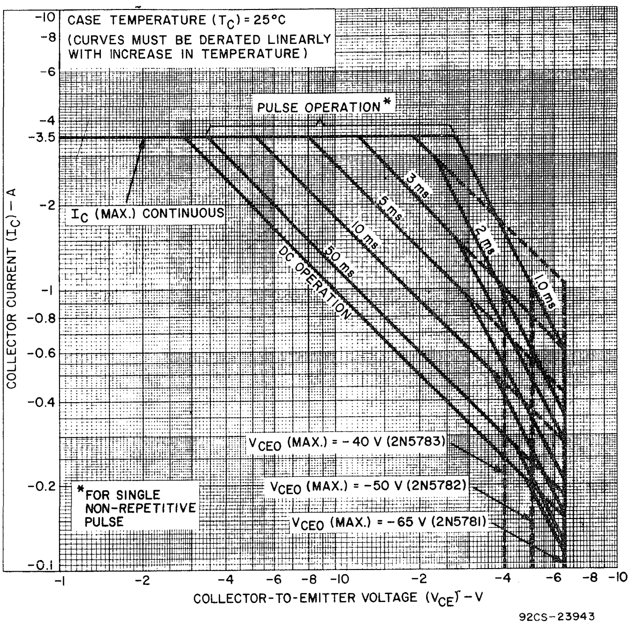


Fig. 14 - Maximum operating areas for types 2N5781, 2N5782, and 2N5783.

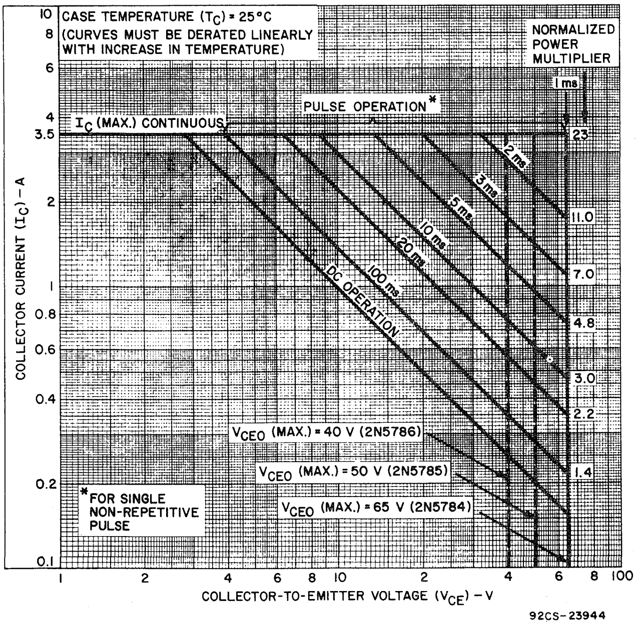


Fig. 15 - Maximum operating areas for types 2N5784, 2N5785, and 2N5786.

2N5838-2N5840

High-Voltage, High-Power Silicon N-P-N Power Transistors

For Switching and Linear Applications in Military, Industrial and Commercial Equipment

RCA 2N5838, 2N5839 and 2N5840** are epitaxial silicon n-p-n power transistors utilizing a multiple-emitter-site structure. These devices employ the popular JEDEC TO-3 package; they differ mainly in voltage, current-gain, and V_{CE}(sat) ratings.

Featuring high breakdown voltage ratings and low-saturation voltage values, the 2N5838, 2N5839 and 2N5840 are especially suitable for use in inverters, deflection circuits, switching regulators, high-voltage bridge amplifiers, ignition circuits, and other high-voltage switching applications.

** Formerly RCA Dev. types TA7513, TA7530, and TA7420 respectively.

Features:

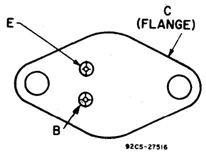
- **Maximum safe-area-of-operation curves**
- **Low saturation voltages**
- **High voltage ratings**

V_{CER}(sus) = 375 V (2N5840)
300 V (2N5839)
275 V (2N5838)

- **High dissipation rating**

P_T = 100 W

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, ***Absolute-Maximum Values:***

	2N5838	2N5839	2N5840	
*COLLECTOR-TO-BASE VOLTAGE, V_{CBO}	275	300	375	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:				
With base open, V_{CEO}(sus)	250	275	350	V
* With reverse bias (V_{BE}) of -1.5 V, V_{CEV}(sus)▲	275	300	375	V
With external base-to-emitter resistance (R_{BE}) ≤ 50 Ω, V_{CER}(sus)	275	300	375	V
*EMITTER-TO-BASE VOLTAGE, V_{EBO}	6	6	6	V
*COLLECTOR CURRENT, I_C				
Continuous	3	3	3	A
Peak	5	5	5	A
*CONTINUOUS BASE CURRENT, I_B	1.5	1.5	1.5	A
*TRANSISTOR DISSIPATION, P_T:				
At case temperature up to 25° C and V_{CE} up to 40 V	100	100	100	W
At case temperatures up to 25° C and V_{CE} above 40 V	See Fig. 5			
At case temperatures above 25° C and V_{CE} above 40 V	See Figs. 1 & 5			
*TEMPERATURE RANGE:				
Storage & Operating (Junction)	-65 to +200			°C
*PIN TEMPERATURE (During Soldering):				
At distances ≥ 1/32 in. (0.8 mm) from case for 10 s max	230			°C

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* In accordance with JEDEC registration data format (JS-6, RDF-1).
▲ Shown as V_{CEX}(sus) in JEDEC Registration Data.

ELECTRICAL CHARACTERISTICS, *Case Temperature (T_C) = 25°C*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS						UNITS
		VOLTAGE V dc		CURRENT A dc		2N5838		2N5839		2N5840		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
Collector-Cutoff Current: With base open	I_{CEO}	200 250				- -	2	- 	- 2	- -	- 2	mA
* With base-emitter junction reverse biased	I_{CEV}	265 290 360	-1.5 -1.5 -1.5			- - -	5 - 	- - 	- 2 -	- - -	- - 2	mA
* With base-emitter junction reverse biased, T_C=100°C	I_{CEV} T_C 100 °C	265 290 360	-1.5 -1.5 -1.5				8 -		5		- - 5	mA
* Emitter-Cutoff Current	I_{EBO}		-6			-	1	-	1	-	1	mA
* Collector-to-Emitter Sustaining Voltage: With base open	V_{CEO}(sus)			0.2[a]		250[b]		275[b]	-	350[b]	-	V
* With base-emitter junction reverse biased	V_{CEX}(sus)		-1.5	0.1[a]		275[b]	-	300[b]	-	375[b]	-	V
With external base-to-emitter resistance (R_{BE}) - 50 Ω	V_{CER}(sus)			0.2[a]		275[b]	-	300[b]	-	375[b]	-	V
* Emitter-to-Base Voltage I_E = 0.02 A	V_{EBO}					6	-	6	-	6	-	V
* DC Forward-Current Transfer Ratio	h_{FE}	5 3 2		0.5[a] 2[a] 3[a]		20 - 8	- - 40	20 10 -	- 50 -	20 10 -	- 50 -	
* Base-to-Emitter Saturation Voltage	V_{BE}(sat)			2[a] 3[a]	0.2 0.375	- -	 2		2	- -	2	V
* Collector-to-Emitter Saturation Voltage	V_{CE}(sat)			2[a] 3[a]	0.2 0.375	 -	 1		1.5	- -	1.5	V
Output Capacitance: V_{CB} = 10 V, f = 1 MHz	C_{obo}					-	150		150		150	pF
* Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f - 1 MHz)	$\|h_{fe}\|$	10		0.2		5		5	-	5	-	
Forward-Bias, Second-Breakdown Collector Current: t = 1 s, nonrepetitive	$I_{S/b}$	40				2.5		2.5		2.5	-	A
Second Breakdown[c] Energy (With base reverse biased) R_B = 50 Ω, L = 100 μH	$E_{S/b}$		-4			0.45	-	0.45	-	0.45	-	mJ
Thermal Resistance: (Junction-to-Case)	$R_{\theta JC}$	10		5			1.75	-	1.75	-	1.75	°C/W

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* In accordance with JEDEC registration data format (JS-6 RDF-1)
a Pulsed; pulse duration = 350 μs, Duty factor ≤ 2%.
b CAUTION: The sustaining voltages V_{CEO}(sus), V_{CEX}(sus) and V_{CER}(sus), MUST NOT be measured on a curve tracer.

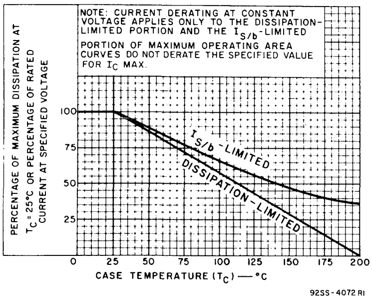


Fig. 1 - Derating curves for all types.

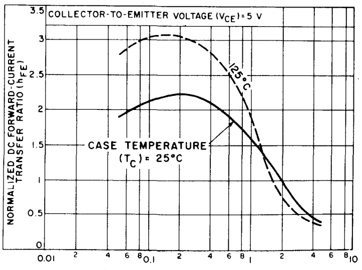


Fig. 2 - Typical normalized dc beta characteristics for all types.

2N5838-2N5840

SWITCHING-TIME CHARACTERISTICS, *At Case Temperature (T_C) = 25°C*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS			LIMITS						UNITS
		VOLTAGE V dc	CURRENT A dc		2N5838		2N5839		2N5840		
		V_{CC}	I_C	I_B●	Max.	Typ.	Max.	Typ.	Max.	Typ.	
Switching Times: Delay	t_d		2	0.2	-	-	-	0.07	-	0.07	μs
		200	3	0.375	-	0.06	-		-	-	
* Rise	t_r		2	0.2	-	-	1.5	0.6	1.75	0.6	
		200	3	0.375	1.5	0.8	-	-	-	-	
* Storage	t_s		2	0.2	-	-	3.75	1.75	3.0	1.75	
		200	3	0.375	3.0	1.0	-		-	-	
* Fall	t_f		2	0.2	-	-	1.5	0.35	1.5	0.35	
		200	3	0.375	1.5	0.4	-	-	-	-	

* In accordance with JEDEC registration data format (JS-6 RDF-1). ● $I_{B1} = I_{B2}$ = value shown.

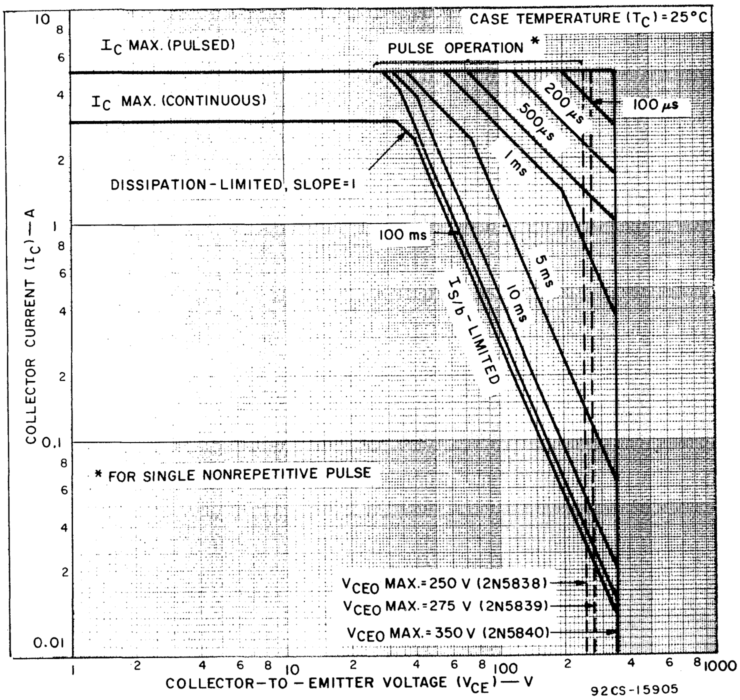


Fig. 5 - Maximum operating areas for all types.

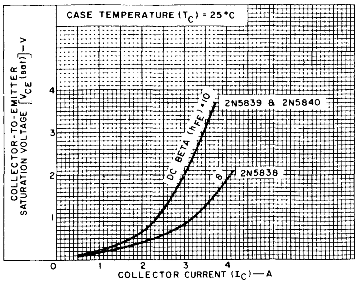


Fig. 3 - Typical saturation voltage characteristics for all types.

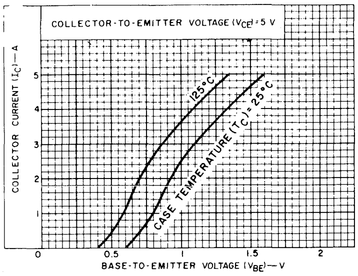


Fig. 4 - Typical transfer characteristics for all types.

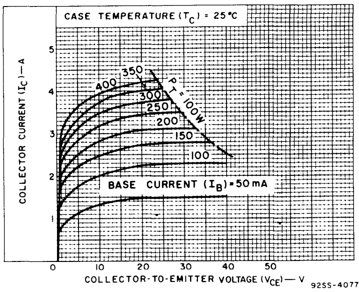


Fig. 6 - Typical output characteristics for all types.

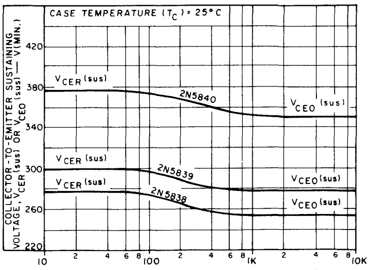


Fig. 7 - Collector-to-emitter sustaining voltage characteristics for all types.

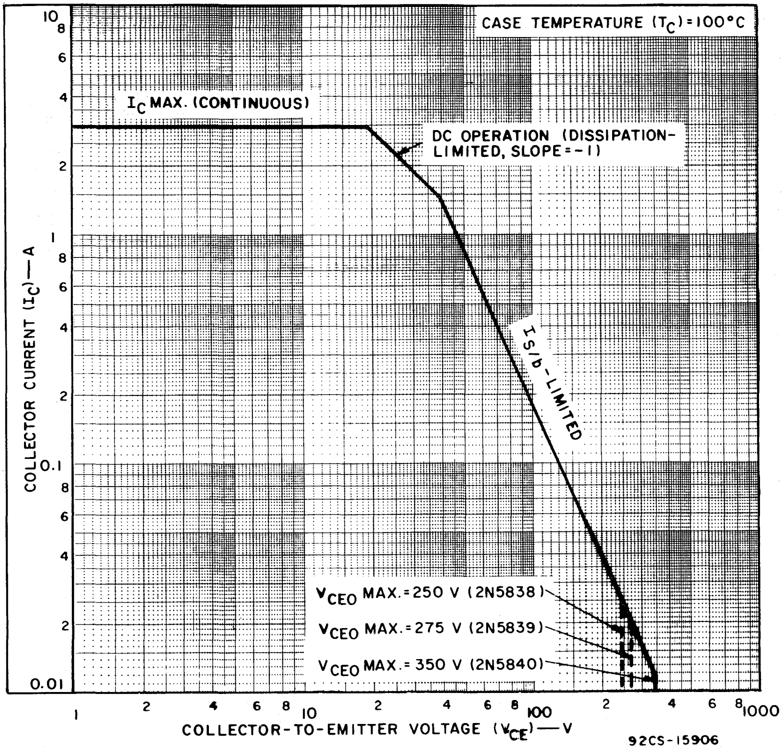


Fig. 8 - Maximum operating areas for all types.

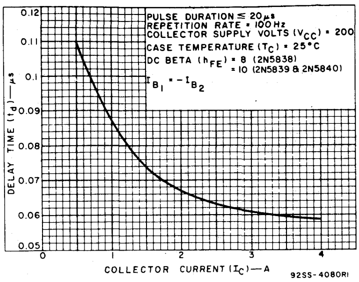


Fig. 9 - Typical delay-time characteristic for all types.

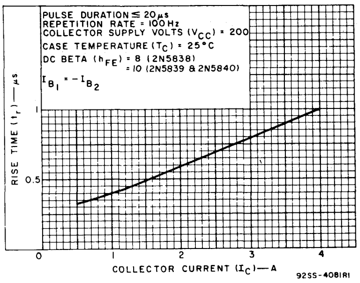


Fig. 10 - Typical rise-time characteristic for all types.

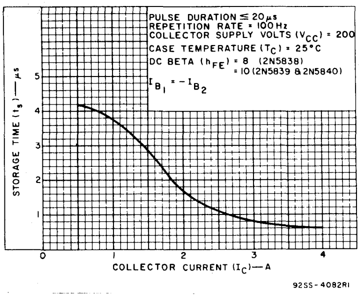


Fig. 11 - Typical storage-time characteristic for all types.

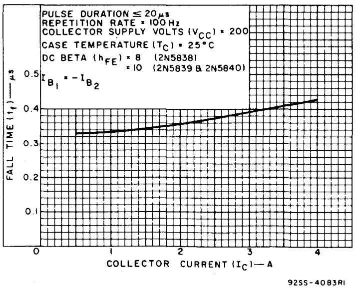


Fig. 12 - Typical fall-time characteristic for all types.

2N5954-2N5956, 2N6372-2N6374, 2N6465-2N6468, 40829-40831

Silicon N-P-N and P-N-P Medium-Power Transistors

General-Purpose Types for Switching Applications

RCA-2N5954, -2N5955, and -2N5956 are multiple-epitaxial p-n-p transistors. RCA-2N6372, -2N6373, and -2N6374 are multiple-epitaxial n-p-n transistors. They are complements to 2N5954, 2N5955, and 2N5956.

The RCA-2N6465 and 2N6466 are multiple-epitaxial n-p-n transistors. They are complements to the 2N6467, and 2N6468, multiple-epitaxial p-n-p transistors. These devices differ in voltage ratings and in the currents at which the parameters are controlled.

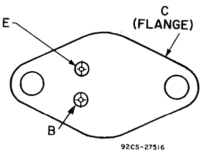
All are supplied in the JEDEC TO-66 package.

Types 2N5954, 2N5955, and 2N5956 are available with factory-attached heat radiators as RCA types 40829, 40830, and 40831, respectively. The other devices may be obtained with heat radiators on special order. Radiator versions are intended for printed-circuit-board applications, and differ electrically from their basic counterparts only in device dissipation (5.8 W up to 25°C ambient) and thermal resistance (30°C/W max. at T_A = 25°C).

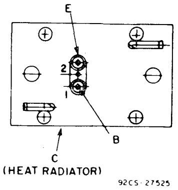
Features:

- **2N5954-2N5956 complements to 2N6372-2N6374**
- **2N6465, 2N6466 complements to 2N6467, 2N6468**
- Low saturation voltages
- Maximum-safe-area-of-operation curves
- Thermal-cycle ratings
- Hermetically-sealed JEDEC TO-66 package

TERMINAL DESIGNATIONS



JEDEC TO-66
2N5954-2N5956 2N6372-2N6374, 2N6465-2N6468



JEDEC TO-66 with Heat Raidator
40829, 40830, 40831

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	N-P-N 2N6374	2N6373	2N6372	2N6465	2N6466	
	P-N-P 2N5956◆ 40831◆	2N5955◆ 40830◆	2N5954◆ 40829◆	2N6467◆	2N6468◆	
*V_{CBO}	50	70	90	110	130	V
*V_{CEX}(sus) V_{BE} = −1.5 V, R_{BE} = 100 Ω	50	70	90	110	130	V
V_{CER}(sus) R_{BE} = 100 Ω	45	65	85	105	125	V
V_{CEO}(sus)	40	60	80	100	120	V
*V_{EBO}	5	5	5	5	5	V
*I_C	6	6	6	4	4	A
*I_B	2	2	2	2	2	A
*P_T						
At T_C up to 25°C	40 (2N6374) (2N5956)	40 (2N6373) (2N5955)	40 (2N6372) (2N5954)	40	40	W
At T_A up to 25°C	5.8 (40831)	5.8 (40830)	5.8 (40829)	–	–	W
At T_C above 25°C	Derate linearly to 200°C					
*T_J, T_{stg}	−65 to +200					°C
*T_L At distances ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max.	+235					°C

*JEDEC types in accordance with JEDEC registration data format JS-6-RDF-2.

◆For p-n-p devices, voltage and current values are negative.

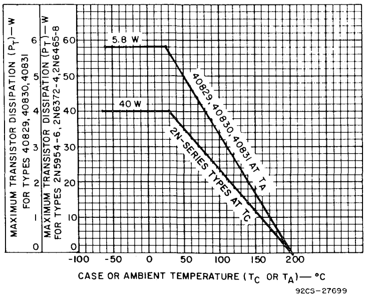


Fig. 1 - Dissipation derating chart for all types.

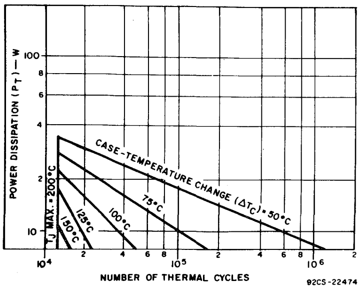


Fig. 2 - Thermal-cycling rating chart for all types.

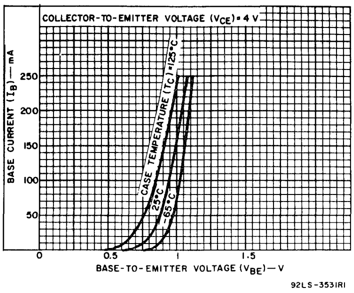


Fig. 3 - Typical input characteristics for 2N5954-56, 2N6372-74 and 40829-31.◆

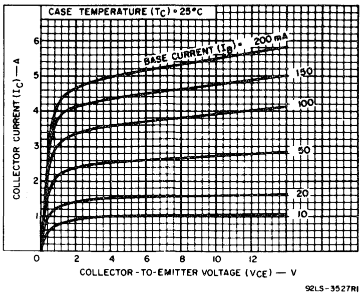


Fig. 4 - Typical output characteristics for 2N5954-56, 2N6372-74 and 40829-31.◆

◆For p-n-p devices, voltage and current values are negative.

2N5954-2N5956, 2N6372-2N6374, 2N6465-2N6468, 40829-40831

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	TEST CONDITIONS◆				LIMITS						UNITS
	VOLTAGE V dc		CURRENT A dc		2N6374 2N5956◆ 40831◆		2N6373 2N5955◆ 40830◆		2N6372 2N5954◆ 40829◆		
	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
* I_{CER} R_{BE}=100 Ω	35 55 75				– – –	100 – –	– – –	– 100 –	– – –	– – 100	µA
* I_{CEX} R_{BE}=100 Ω	45 65 85	–1.5 –1.5 –1.5			– – –	100 – –	– – –	– 100 –	– – –	– – 100	µA
* R_{BE}=100 Ω, T_C=150°C	45 65 85	–1.5 –1.5 –1.5			– – –	2 – –	– – –	– 2 –	– – –	– – 2	mA
* I_{CEO}	25 45 65				– – –	1 – –	– – –	– 1 –	– – –	– – 1	mA
* I_{EBO}		–5			–	0.1	–	0.1	–	0.1	mA
* h_{FE}	4 4 4 4		3^a 2.5^a 2^a 6^a		20 – – 5	100 – – –	– 20 – 5	– 100 – –	– – 20 5	– – 100 –	
* V_{CEO}(sus)			0.1^a		40^b	–	60^b	–	80^b	–	V
V_{CER}(sus) R_{BE}=100 Ω			0.1^a		45^b	–	65^b	–	85^b	–	
V_{CEX}(sus) R_{BE}=100 Ω		–1.5	0.1^a		50^b	–	70^b	–	90^b	–	
* V_{BE} All types All types All types 2N6372-2N6374	4 4 4 4		3^a 2.5^a 2^a 6^a		– – – –	2 – – 3	– – – –	– 2 – 3	– – – –	– – 2 3	V
* V_{CE}(sat) 2N5954–2N5956			3^a 2.5^a 2^a 6	0.3 0.25 0.2 1.2	– – – –	1 – – 2	– – – –	– 1 – 2	– – – –	– – 1 2	V
* $\|h_{fe}\|$ f=1 MHz 2N6372-2N6374 2N5954-56,40829-31	4 –4		1 –1		4 5	– –	4 5	– –	4 5	– –	
* h_{fe} f=1 kHz	4		0.5		25	–	25	–	25	–	
$R_{\theta JC}$ 2N5954-56, 2N6372-74					–	4.3	–	4.3	–	4.3	°C/W
$R_{\theta JA}$ 40829-40831					–	30	–	30	–	30	

* In accordance with JEDEC registration data format JS-6 RDF-2 for JEDEC (2N5954-2N5956 2N6372-2N6374 2N6465-2N6468 40829-40931) types.

◆ For p-n-p devices, voltage and current values are negative.

[a] Pulsed, pulse duration = 300 µs, duty factor = 1.8%.

[b] *CAUTION: Sustaining voltages V_{CEO}(sus), V_{CER}(sus), and V_{CEX}(sus) MUST NOT be measured on a curve tracer.*

◆For p-n-p devices, voltage and current values are negative.

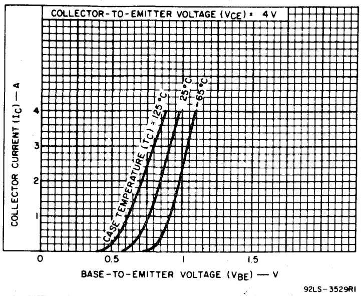


Fig. 5 - Typical transfer characteristics for 2N5954-56, 2N6372-74 and 40829-31.◆

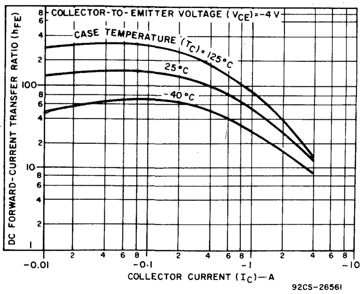


Fig. 6 - Typical dc beta characteristics for 2N6467 and 2N6468.

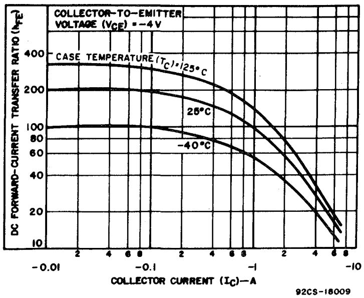


Fig. 7 - Typical dc beta characteristics for 2N5954-2N5956 and 40829-40831.

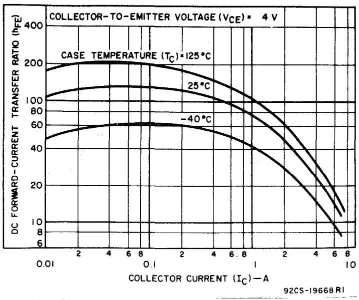


Fig. 8 - Typical dc beta characteristics for 2N6372-2N6374.

2N5954-2N5956, 2N6372-2N6374, 2N6465-2N6468, 40829-40831

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	TEST CONDITIONS VOLTAGE V dc V_{CE}	V_{BE}	CURRENT A dc I_C	I_B	LIMITS 2N6465 2N6467◆ Min.	Max.	2N6486 2N6468◆ Min.	Max.	UNITS
I_{CER} R_{BE} = 100 Ω	95 100				– –	100 –	– –	– 100	μA
* I_{CEX} R_{BE} = 100 Ω	100 120	−1.5 −1.5			– –	100 –	– –	– 100	μA
R_{BE} = 100 Ω, T_C = 150°C	100 120	−1.5 −1.5			– –	2 –	– –	– 2	mA
* I_{CEO}	50 60				– –	1 –	– –	– 1	mA
* I_{EBO}		−5			–	0.1	–	0.1	mA
* h_{FE}	4 4		1.5[a] 4[a]		15 5	150 –	15 5	150 –	
* $V_{CEO}(sus)$			0.1[a]		100[b]	–	120[b]	–	V
$V_{CER}(sus)$ R_{BE} = 100 Ω			0.1[a]		105[b]	–	125[b]	–	
* $V_{CEX}(sus)$ R_{BE} = 100 Ω		−1.5	0.1[a]		110[b]	–	130[b]	–	
* V_{BE}	4 4		1.5[a] 4[a]		– –	2 3.5	– –	2 3.5	V
$V_{CE}(sat)$ All types 2N6465–2N6466 2N6467–2N6468			1.5[a] 4[a] −4[a]	0.15 0.8 −0.8	– –	1.2 3* −4*	– – –	1.2 3* −4*	V
* $\|h_{fe}\|$ f = 1 MHz	4		1		5	–	5	–	
* h_{fe} f = 1 kHz	4		0.5		25	–	25	–	
$R_{\theta JC}$					–	4.3	–	4.3	°C/W

* In accordance with JEDEC registration data format JS-6 RDF-2.

◆ For p-n-p devices, voltage and current values are negative.

[a] Pulsed, pulse duration = 300 μs, duty factor = 1.8%

[b] *CAUTION: Sustaining voltages $V_{CEO}(sus)$, $V_{CER}(sus)$, and $V_{CEX}(sus)$ MUST NOT be measured on a curve tracer.*

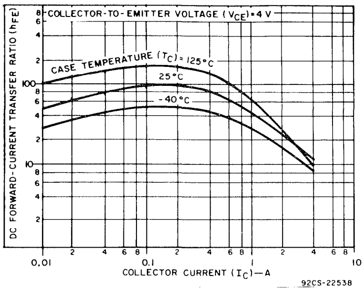


Fig. 9 - Typical dc beta characteristics for 2N6465 and 2N6466.

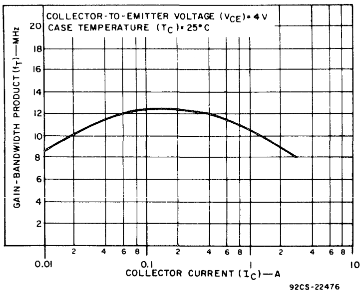


Fig. 10 - Typical gain-bandwidth product for 2N5954-56, 2N6372-74, 2N6467-68, and 40829-31. (For p-n-p devices, voltage and current values are negative.)

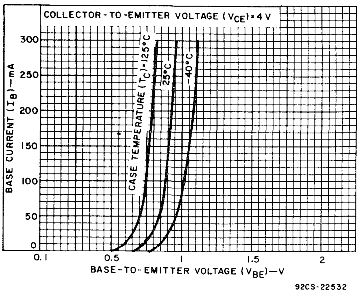


Fig. 11 - Typical input characteristics for 2N6465 and 2N6466.

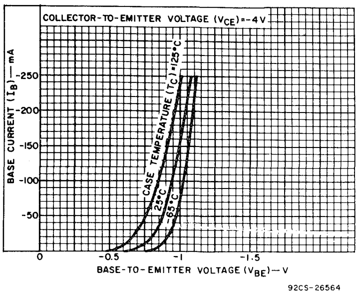


Fig. 12 - Typical input characteristics for 2N6467 and 2N6468.

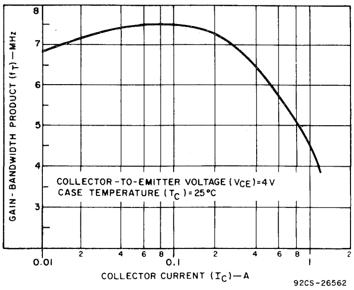


Fig. 13 - Typical gain-bandwidth product for 2N6465 and 2N6466.

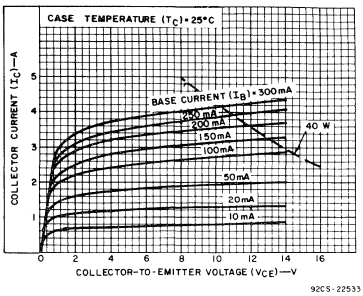


Fig. 14 - Typical output characteristics for 2N6465 and 2N6466.

2N5954-2N5956, 2N6372-2N6374, 2N6465-2N6468, 40829-40831

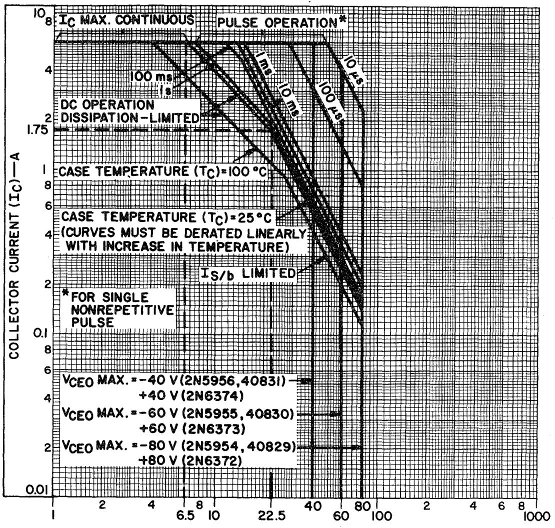


Fig. 15 - Maximum operating areas for 2N5954-56, 2N6372-74, and 40829-31.◆

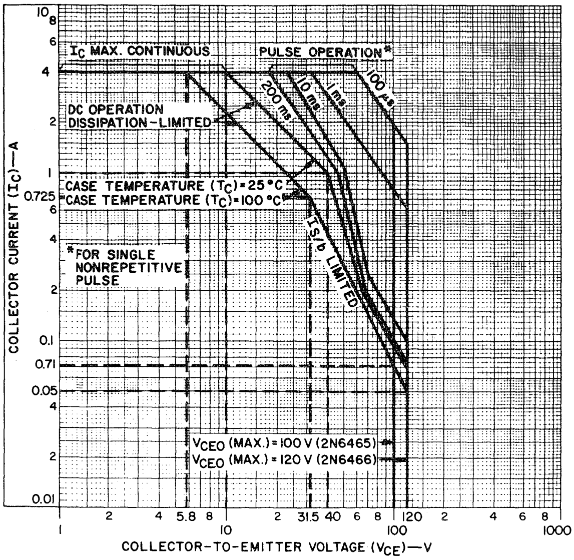


Fig. 16 - Maximum operating areas for 2N6465 and 2N6466.

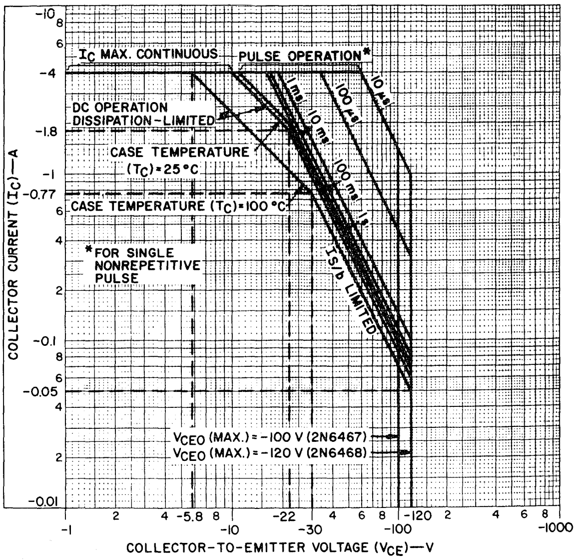


Fig. 17 - Maximum operating areas for 2N6467 and 2N6468.

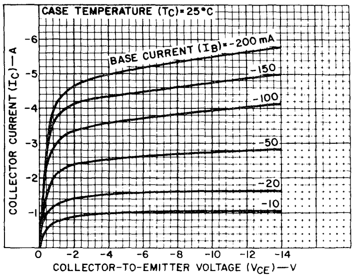


Fig. 18 - Typical output characteristics for 2N6467 and 2N6468.

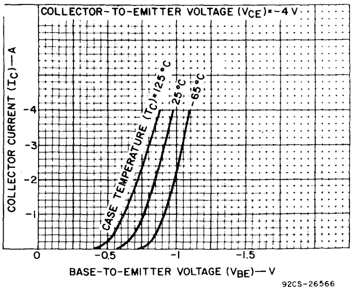


Fig. 19 - Typical transfer characteristics for 2N6467 and 2N6468.

◆For p-n-p devices, voltage and current values are negative.

2N5954-2N5956, 2N6372-2N6374, 2N6465-2N6468, 40829-40831

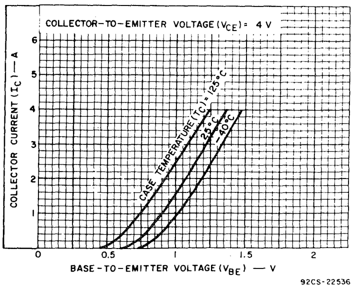


Fig. 20 - Typical transfer characteristics for 2N6465 and 2N6466.

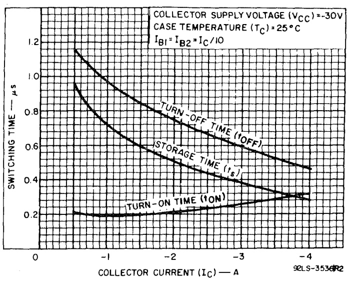


Fig. 21 - Typical saturated switching characteristics for 2N5954-56 and 40829-31.

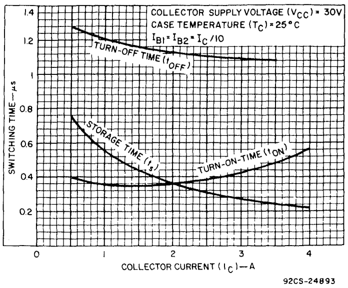


Fig. 22 - Typical saturated switching characteristics for 2N6372-2N6374.

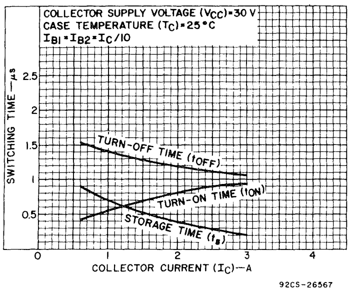


Fig. 23 - Typical saturated switching characteristics for 2N6465 and 2N6466.

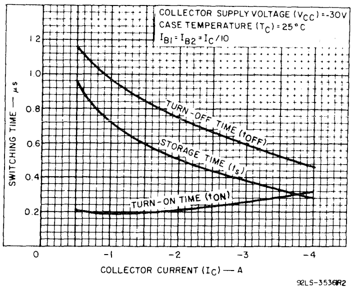


Fig. 24 - Typical saturated switching characteristics for 2N6467 and 2N6468.

2N6032, 2N6033

High-Current, High-Speed, High-Power Transistors

Silicon N-P-N Types

For Switching and Amplifier Applications
in Military, Industrial, and Commercial Equipment

RCA Types 2N6032 and 2N6033* are epitaxial silicon n-p-n transistors having high-current and high-power handling capability and fast switching speed. The 2N6033 is similar to the 2N6032; they differ in maximum values for continuous collector current and sustaining voltage.

They are supplied in modified TO-3 hermetic steel packages with 0.60-in. diameter pins.

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*Formerly RCA Dev. Types TA7337 and TA7337A, respectively.

Applications:

- **Switching-control amplifiers**
- **Power gates**
- **Switching regulators**
- **Power-switching circuits**
- **Power oscillators**
- **DC-RF amplifiers**
- **Converters**
- **Inverters**
- **Control circuits**

Features:

- **Low V_{CE}(sat) = 1.0 V max. at 40 A, 1.3 V max. at 50 A**
- **Maximum Safe-Area-of-Operation Curve. . . $I_{S/b}$ limit line beginning at 24 V**
- **Fast Storage Time . . . t_s = 1.5 μs max at I_C = 40 A (2N6033) 50A (2N6032)**
- **High-Current Capability . . . V_{CE}(sat) & V_{BE} measured at I_C = 40 A (2N6033)**
  = 50 A (2N6032)
- **High P_T (140 W max. at T_C = 25°C)**

MAXIMUM RATINGS, *Absolute Maximum Values:*

		2N6032	2N6033	
* COLLECTOR-TO-BASE VOLTAGE . . .	V_{CBO}	120	150	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:				
With base open	V_{CEO}(sus)	90	120	V
With external base-to-emitter resistance (R_{BE}) ≤ 50 Ω	V_{CER}(sus)	110	140	V
* With external base-to-emitter resistance (R_{BE}) ≤ 50 Ω & V_{BE} = -1.5 V	V_{CEX}(sus)	120	150	V
* EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	7	V
* CONTINUOUS COLLECTOR CURRENT	I_C	50	40	A
* BASE CURRENT	I_B	10	10	A
* EMITTER CURRENT	I_E	50	40	A
* TRANSISTOR DISSIPATION:	P_T			
At case temperatures up to 25°C and V_{CE} up to 24 V		140	140	W
At case temperatures above 25°C		Derate linearly to 200°C		
* TEMPERATURE RANGE:				
Storage & Operating (Junction)		-65 to +200		°C
* PIN TEMPERATURE (During Soldering):				
At distances ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max		230		°C

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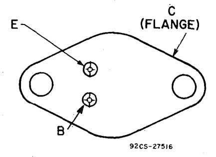
*In accordance with JEDEC registration data format JS-6 RDF-1.

TERMINAL DESIGNATIONS



Modified JEDEC TO-3

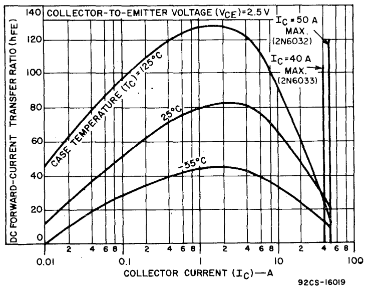


Fig. 2 - Typical dc-beta characteristics for both types.

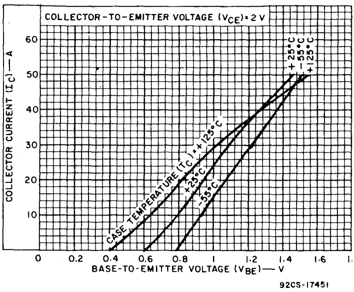


Fig. 3 - Typical transfer characteristics for both types.

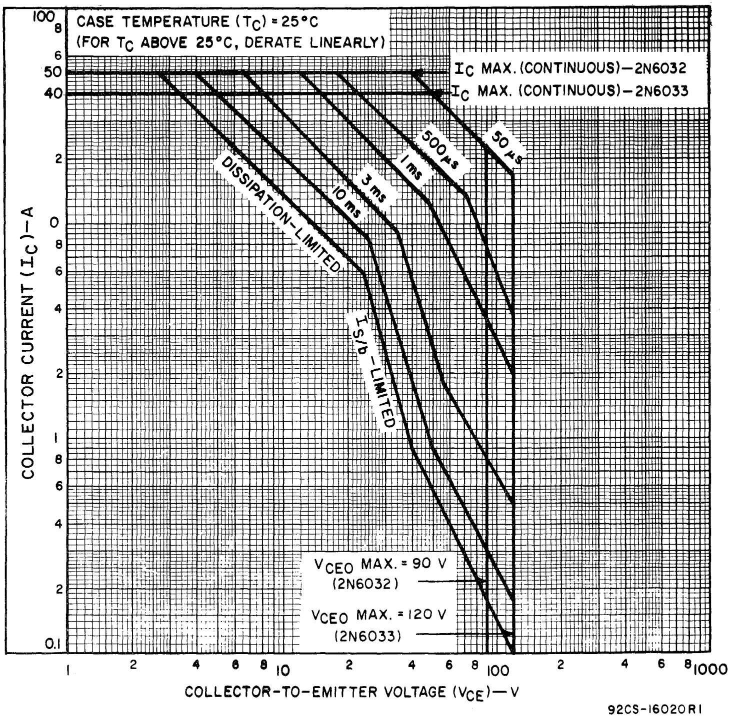


Fig. 1 - Maximum operating areas for both types.

2N6032, 2N6033

ELECTRICAL CHARACTERISTICS, Case Temperature (T_C) = 25°C Unless Otherwise Specified

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS				UNITS
		VOLTAGE V dc		CURRENT A dc		2N6032		2N6033		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min	Max.	
Collector-Cutoff Current: With base open	I_{CEO}	80	–	–	0	–	10	–	10	mA
* With base-emitter junction reverse biased	I_{CEV}	110 135	-1.5 -1.5	– –	– –	– –	12	– –	– 10	mA
T_C = 150°C		100	-1.5	–	–	–	15	–	10	mA
* Emitter-Cutoff Current	I_{EBO}	–	–7	0	–	–	10	–	10	mA
Collector-to-Emitter Sustaining Voltage: *(See Figs. 12 & 13)* * With base open	$V_{CEO}(sus)$	–	–	0.2^b	0	90^a	–	120^a	–	V
With external base to emitter resistance (R_{BE}) $\leq$ 50 Ω	$V_{CER}(sus)$	–	–	0.2^b	0	110^a	–	140^a	–	
With base-emitter junction reverse biased & $R_{BE} \leq$ 50 Ω	$V_{CEX}(sus)$	–	-1.5	0.2^b	0	120^a	–	150^a	–	
* Base-to-Emitter Saturation Voltage	$V_{BE}(sat)$	– –	– –	50^b 40^b	5 4	– –	2 –	– –	– 2	V
Base-to-Emitter Voltage	V_{BE}	2 2	– –	50^b 40^b	– –	– –	2 –	– –	– 2	V
* Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$	– –	– –	50^b 40^b	5 4	– –	1.3 –	– –	– 1	V
* DC Forward-Current Transfer Ratio	h_{FE}	2.6 2	– –	50^b 40^b	– –	10 –	50 –	– 10	– 50	
Second-Breakdown Collector Current With base forward biased, t = 1 s nonrepetitive	$I_{S/b}$	24 40	– –	– –	– –	5.8^c 0.9^c	– –	5.8^c 0.9^c	– –	A
Second-Breakdown Energy With base reverse biased (L = 310 μH, R_{BE} = 5 Ω)	$E_{S/b}$	–	-4	20	–	62	–	62	–	mJ
* Magnitude of common-emitter small-signal, short-circuit, forward-current transfer ratio f = 5 MHz	$\lvert h_{fe} \rvert$	10		2		10	–	10	–	
* Gain-Bandwidth Product f = 5 MHz	f_T	10	–	2	–	50	–	50	–	MHz
Output Capacitance: V_{CB} = 10 V, f = 1 MHz	C_{obo}	–	–	–	–	–	800	–	800	pF
Thermal Resistance (Junction-to-Case)	$R\theta_{JC}$	10	–	10	–	–	1.25	–	1.25	°C/W

*In accordance with JEDEC registration format JS-6 RDF-1.

[a] CAUTION: The sustaining voltages $V_{CEO}(sus)$, $V_{CER}(sus)$, and $V_{CEX}(sus)$ MUST NOT be measured on a curve tracer.

[b] Pulsed: Pulse duration 300 μs; duty factor ≤ 2%.

SWITCHING TIME CHARACTERISTICS, *Case Temperature (T_C) = 25°C*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS				UNITS
		VOLTAGE V dc		CURRENT A dc		2N6032		2N6033		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
Saturated Switching Time: (V_{CC}=30 V, I_{B1} = I_{B2}):										
* Rise Time	t_r	– –	– –	50 40	5 4	– –	1 —	– –	– 1	μs
* Storage Time	t_s	– –	– –	50 40	5 4	– –	1.5 –	– –	– 1.5	μs
* Fall Time	t_f	– –	– –	50 40	5 4	– –	0.5 –	– –	– 0.5	μs

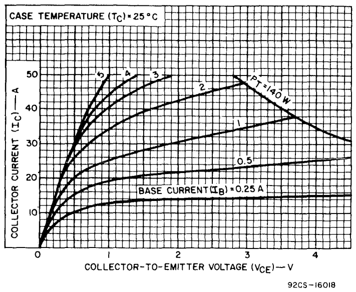


Fig. 4 - Typical output characteristics for both types.

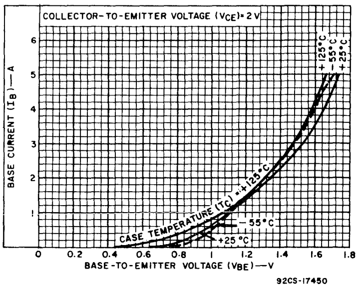


Fig. 5 - Typical input characteristics for both types.

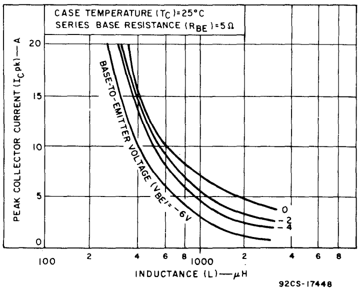


Fig. 6 - Maximum reverse-bias second-breakdown characteristics for both types.

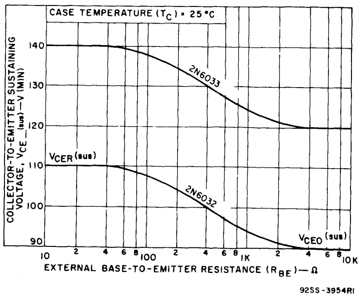


Fig. 7 - Collector-to-emitter sustaining voltage characteristics for both types.

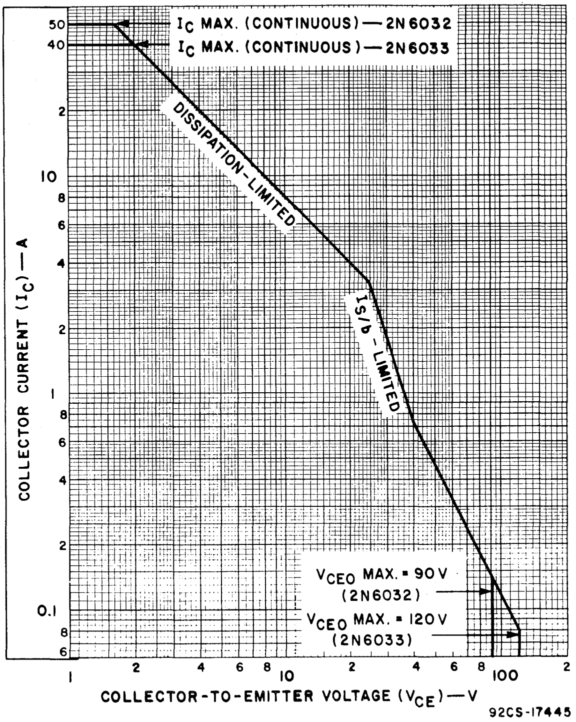


Fig. 8 - Maximum operating areas for both types at case temperature (T_C) = 100°C.

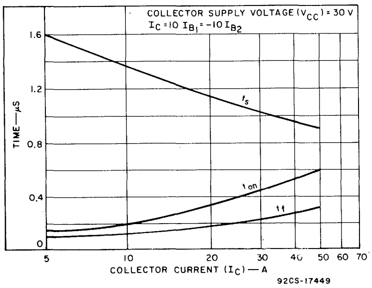


Fig. 9 - Typical saturated switching characteristics for both types.

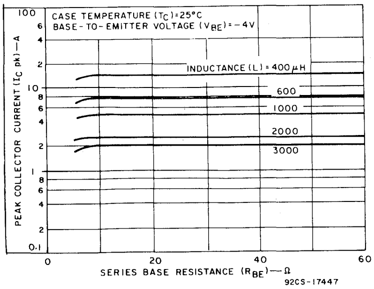


Fig. 10 - Maximum reverse-bias second-breakdown characteristics for both types.

2N6077-2N6079

High-Voltage, High-Power Silicon N-P-N Transistors

For Switching and Linear Applications

RCA 2N6077, 2N6078 and 2N6079 are multiple epitaxial silicon n-p-n power transistors utilizing a multiple-emitter-site structure. Multiple-epitaxial construction maximizes the volt-ampere characteristic of the device and provides fast switching speeds. Multiple-emitter-site design ensures uniform current flow throughout the structure, which produces a high $I_{S/b}$ and a large safe-operation area.

These devices use the popular JEDEC TO-66 package; they differ mainly in voltage ratings, leakage-current limits, and $V_{CE}(sat)$ ratings.

The 2N6077 is characterized for switching applications with load lines in the active region. These applications include sweep circuits and all circuits using the transistor as an active voltage clamp.

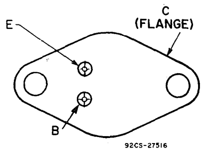
Type 2N6078 is characterized for switching applications with the load line extending into the reverse-bias region. Its voltage ratings make this device useful for switching regulators operating directly from a rectified 110-V or 220-V power line. The unit is rated to take surge currents up to 5 A and maintain saturation.

The 2N6079 is characterized for use in inverters operating directly from a rectified 110-V power line. The leakage current is specified at 450 volts; therefore the device can also be used in a series bridge configuration on a 220-V line. The V_{EBO} rating of 9 volts eases requirements on the drive transformer in inverter applications. Storage time, an important factor in the frequency stability of an inverter, is specified in Fig. 11, which shows variation in storage time with variation in load current from zero to maximum (4 A).

Features:

- **Maximum safe-area-of-operation curves**
- **Low saturation voltages**
- **High voltage ratings:**
  $V_{CER}(sus)$ = 300 V (2N6077)
  275 V (2N6078)
  375 V (2N6079)
- **High dissipation rating: P_T = 45 W**

TERMINAL DESIGNATIONS



JEDEC TO-66

MAXIMUM RATINGS, *Absolute-Maximum Values:*		2N6077	2N6078	2N6079	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	300	275	375	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:					
With base open	$V_{CEO}(sus)$	275	250 1	350	V
* With reverse bias (V_{BE}) of −1.5 V	$V_{CEX}(sus)$	300	275	375	V
With external base-to-emitter resistance (R_{BE}) $\leqslant$ 500 Ω	$V_{CER}(sus)$	300	275	375	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	6	6	9	V
*COLLECTOR CURRENT:	I_C				
Continuous		7	7	7	A
Peak		10	10	10	A
*CONTINUOUS BASE CURRENT	I_B	4	4	4	A
*TRANSISTOR DISSIPATION:	P_T				
At case temperatures up to 25°C		45	45	45	W
At case temperatures above 25°C		Derate linearly to 200°C			
*TEMPERATURE RANGE:					
Storage & Operating (Junction)		−65 to +200			°C
*PIN TEMPERATURE (During Soldering):					
At distances $\geqslant$ 1/32 in. (0.8 mm) from case for 10 s max.		230			°C

* 2N-Series types in accordance with JEDEC registration data format (JS-6, RDF-1).

2N6077-2N6079

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC SYMBOL	TEST CONDITIONS				LIMITS									UNITS
	VOLTAGE V dc		CURRENT A dc		2N6077			2N6078			2N6079			
	V_{CE}	V_{BE}	I_C	I_B	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
I_{CEO}	250	−1.5		0	–	–	2	–	–	–	–	–	–	mA
* I_{CEV}	250 450	−1.5 −1.5			– –	– –	5 –	– –	– –	0.05 –	– –	– –	– 0.5	mA
(T_C = 125°C)	250 450	−1.5 −1.5			– –	– –	8 –	– –	– –	0.2 –	– –	– –	– 5	mA
* I_{EBO}		−6 −9	0 0		– –	– –	1 –	– –	– –	1 –	– –	– –	– 1	mA
* V_{CEO}(sus)			0.2^a		275^b	–	–	250^b	–	–	350^b	–	–	V
V_{CER}(sus) (R_{BE} = 500 Ω)			0.2^a		300^b	–	–	275^b	–	–	375^b	–	–	
* V V_{EBO} (I_E = 1 mA)			0		6	–	–	6	–	–	9	–	–	V
* h_{FE}	1		1.2^a		12	28	70	12	28	70	12	28	50	
* V_{BE}(sat)			1.2^a 3^a 4^a 5^a	0.2 0.6 0.8 1	– – – –	1.0 1.2 – –	1.6 1.9 – –	– – – –	1.0 – – 1.5	1.6 – – 2	– – – –	1.0 – 1.3 –	1.6 – 2 –	V
* V_{CE}(sat)			1.2^a 3^a 4^a 5^a	0.2 0.6 0.8 1	– – – –	0.15 0.25 – –	0.5 1 – –	– – – –	0.15 – – 0.8	0.5 – – 3	– – – –	0.15 – 0.5 –	0.5 – 3 –	V
C_{obo} (V_{CB}=10 V, f = 1 MHz)					–	–	150	–	–	150	–	–	150	pF
* $\|h_{fe}\|$ (f = 1 MHz)	10		0.2		1	7	–	1	7	–	1	7	–	
$I_{S/b}$ (Pulse duration (non-repetitive) = 1 s)	50				0.9	–	–	0.9	–	–	0.9	–	–	A
$E_{S/b}$ (R_B = 50Ω, L=100µH)		−4	3●		0.45	–	–	0.45	–	–	0.45	–	–	mj
t_d^c			1.2	0.2	–	0.02	–	–	0.02	–	–	0.02	–	µs
* t_r^c			1.2	0.2	–	0.3	0.75	–	0.3	0.75	–	0.3	0.75	
* t_s^c			1.2	0.2	–	2.8	5	–	2.8	5	–	2.8	5	
* t_f^c			1.2	0.2	–	0.3	0.75	–	0.3	0.75	–	0.3	0.75	
$R_{\theta JC}$	20		2.25		–	–	3.9	–	–	3.9	–	–	3.9	°C/W

*2N-series types in accordance with JEDEC registration data format (JS-6, RDF-1).

[a] Pulsed; pulse duration ≤ 350 µs, Duty factor = 2%.

[b] CAUTION: The sustaining voltages V_{CEO}(sus), and V_{CER}(sus), MUST NOT be measured on a curve tr

[c] V_{CC} = 250 V, I_{B1} = I_{B2}.

2N6077-2N6079

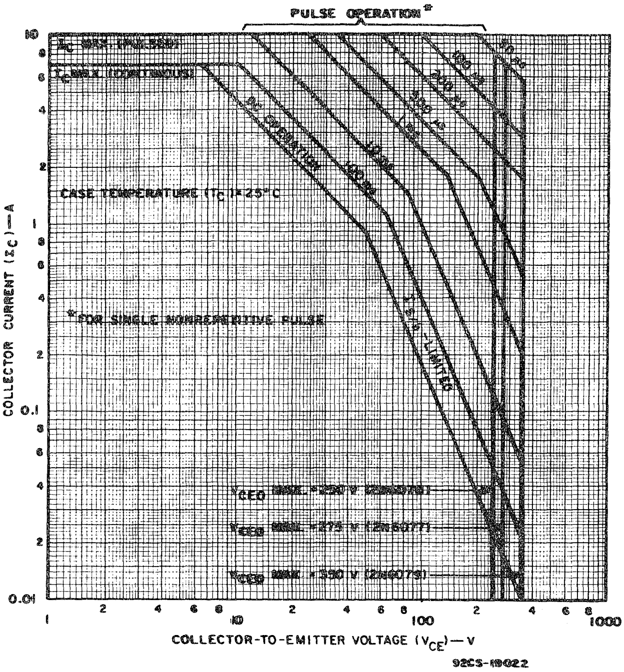


Fig. 1 - Maximum operating areas for all types.

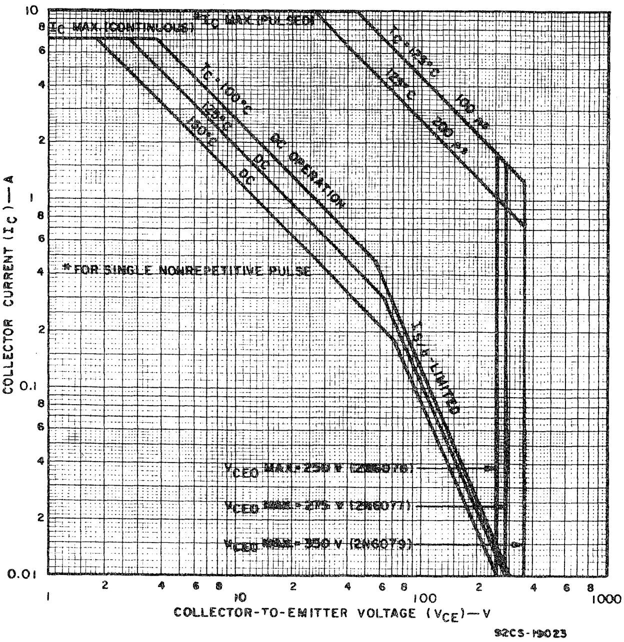


Fig. 4 - Maximum operating areas for all types.

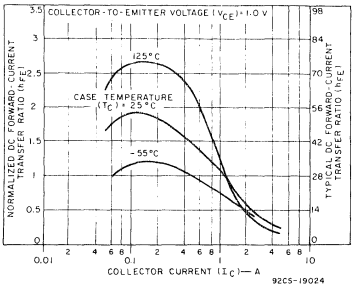


Fig. 2 - Typical normalized dc beta characteristics for all types.

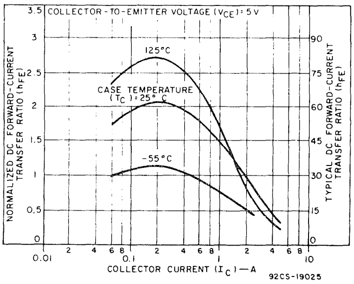


Fig. 3 - Typical normalized dc beta characteristics for all types.

Note (Figs. 2 & 3): To estimate min., max. h_{FE} at any current and temperature, read normalized dc forward-current transfer ratio and multiply by min., max. specifications given in Electrical Characteristics Chart.

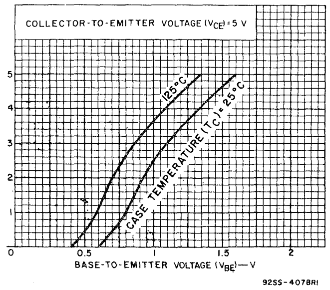


Fig. 5 - Typical transfer characteristics for all types.

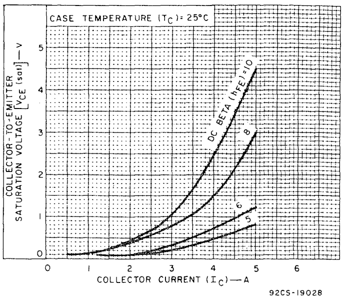


Fig. 6 - Typical saturation voltage characteristics for all types.

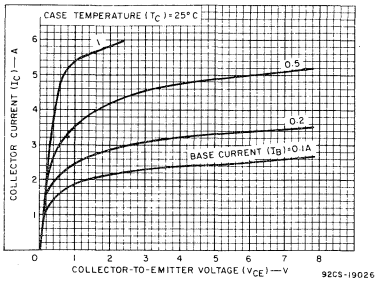


Fig. 7 - Typical output characteristics for all types.

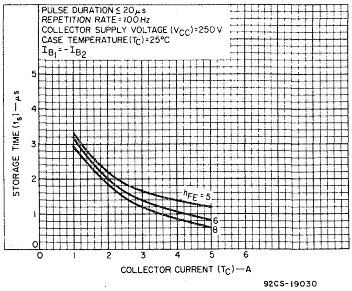


Fig. 8 - Typical storage-time characteristics for all types (with constant forced gain).

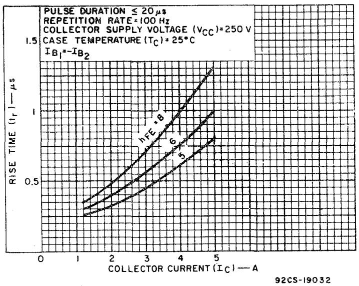


Fig. 9 - Typical rise-time characteristic for all types.

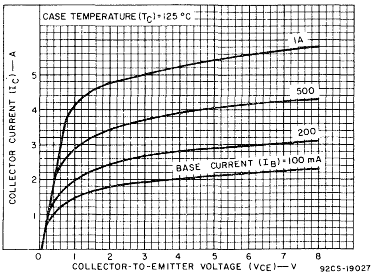


Fig. 10 - Typical output characteristics for all types.

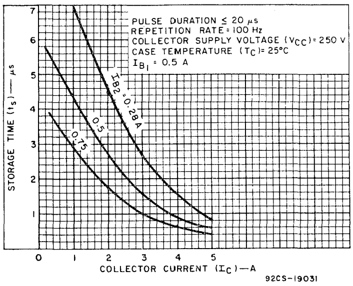


Fig. 11 - Typical storage-time characteristics for all types (with constant-base drives).

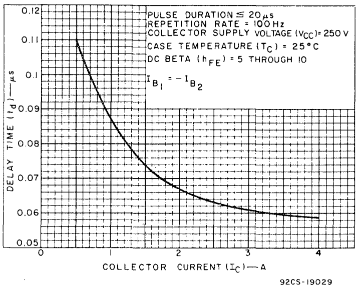


Fig. 12 - Typical delay-time characteristic for all types.

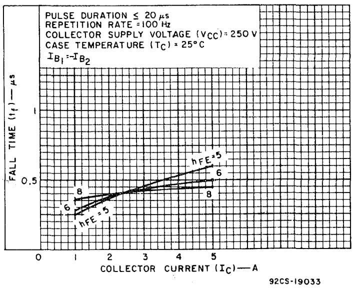


Fig. 13 - Typical fall-time characteristic for all types.

2N6098-2N6103, RCA3055

High-Current, Silicon N-P-N VERSAWATT Transistors

Designed for Medium-Power Linear and Switching Service in Consumer, Automotive, and Industrial Applications

These RCA types are hometaxial-base silicon n-p-n transistors. Types 2N6098, 2N6100, and 2N6102 have formed emitter and base leads for easy insertion into TO-66 sockets. Types 2N6099, 2N6101, and 2N6103 are electrically identical to the 2N6098, 2N6100, and 2N6102, respectively.

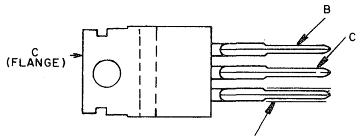
These new VERSAWATT package transistors differ in voltage ratings and in the currents at which the parameters are controlled. They are intended for a wide variety of medium-power switching and linear applications, such as series and shunt regulators, solenoid drivers, motor-speed controls, inverters, and driver and output stages of high-fidelity amplifiers.

OPTIONAL LEAD CONFIGURATION
An additional lead forming for printed-circuit board mounting is also available. Please submit requirements to your RCA Technical Sales Representative, or write to RCA Power Marketing, Somerville, N. J. 08876.

Features:

- **Low saturation voltage –**
  $V_{CE}(sat)$ = 1 V max. at I_C = 4 A (2N6098, 2N6099)
  = 1 V max. at I_C = 5 A (2N6100, 2N6101)
  = 1 V max. at I_C = 8 A (2N6102, 2N6103)
- **VERSAWATT package (molded-silicone plastic)**
- **Maximum safe-area-of-operation curves**
- **Thermal-cycle rating curve**

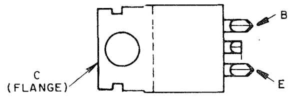
TERMINAL DESIGNATIONS



BOTTOM VIEW

92CS-27519

JEDEC TO-220AB
2N6099, 2N6101, 2N6103



BOTTOM VIEW

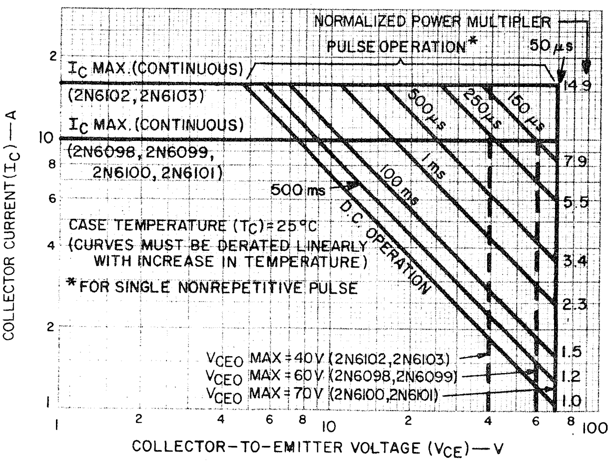
92CS-27520

JEDEC TO-220AA
2N6098, 2N6100, 2N6102

MAXIMUM RATINGS, *Absolute-Maximum Values:*

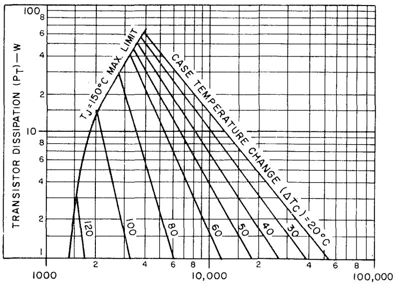
		2N6102 2N6103	2N6098 2N6099	2N6100 2N6101	RCA3055	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	45	70	80	100	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:						
With external base-to-emitter resistance (R_{BE}) = 100Ω	$V_{CER}(sus)$	45	65	75	70	V
* With base open	$V_{CEO}(sus)$	40	60	70	60	V
With base reverse-biased V_{BE} = −1.5 V	$V_{CEV}(sus)$	–	–	–	90	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	8	8	7	V
*COLLECTOR CURRENT (Continuous)	I_C	16	10	10	15	A
*BASE CURRENT	I_B	4	4	4	4	A
TRANSISTOR DISSIPATION:	P_T					
* At case temperatures up to 25°C		75	75	75	75	W
At ambient temperatures up to 25°C		1.8	1.8	1.8	1.8	W
* At case temperatures above 25°C, derate linearly		0.6				W/°C
At ambient temperatures above 25°C, derate linearly		0.0144				W/°C
*TEMPERATURE RANGE:						
Storage & Operating (Junction)		−65 to 150				°C
*LEAD TEMPERATURE (During Soldering):						
At distance ≥ 1.8 in. (3.17 mm) from case of 10 s max.		235				°C

* 2N-Series types in accordance with JEDEC registration data format JS-6 RDF-2.



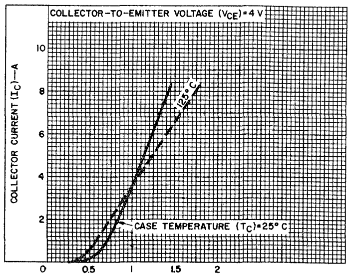
92CS-17954

Fig. 1 – Maximum safe operating areas for 2N6098-2N6103, inclusive.



92CS-17955

Fig. 2 – Thermal-cycling rating for all types.



92CS-15987

Fig. 3 – Typical transfer characteristics for all types.

2N6098-2N6103, RCA3055

ELECTRICAL CHARACTERISTICS, *Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC SYMBOL	TEST CONDITIONS				LIMITS								UNITS
	VOLTAGE V dc		CURRENT A dc		2N6102 2N6103		2N6098 2N6099		2N6100 2N6101		RCA3055		
	V_{CE}	V_{EB}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
* I_{CEX}	40	1.5			–	2	–	–	–	–	–	–	mA
	65	1.5			–	–	–	2	–	–	–	–	
	75	1.5			–	–	–	–	–	2	–	–	
	100	1.5			–	–	–	–	–	–	–	5	
* I_{CEX} (T_C = 150°C)	40	1.5			–	10	–	–	–	–	–	–	
	65	1.5			–	–	–	10	–	–	–	–	
	75	1.5			–	–	–	–	–	10	–	–	
	100	1.5			–	–	–	–	–	–	–	30	
* I_{CEO}	30			0	–	2	–	–	–	–	–	0.7	mA
	50			0	–	–	–	2	–	–	–	–	
	60			0	–	–	–	–	–	2	–	–	
* I_{EBO}		5	0		–	1	–	–	–	–	–	–	mA
		7	0		–	–	–	–	–	–	–	5	
		8	0		–	–	–	1	–	1	–	–	
V_{CER}(sus) R_{BE} = 100Ω[a]			0.2		45	–	65	–	75	–	70	–	V
* V_{CEO}(sus)[a]			0.2	0	40	–	60	–	70	–	60	–	
V_{CEV}(sus)[a]		1.5	0.1		–	–	–	–	–	–	90	–	
* h_{FE}[a]	4		4		–	–	20	80	–	–	20	70	
	4		5		–	–	–	–	20	80	–	–	
	4		8		15	60	–	–	–	–	–	–	
	4		10		–	–	5	–	5	–	5	–	
	4		16		5	–	–	–	–	–	–	–	
* V_{BE}[a]	4		4		–	–	–	1.7	–	–	–	1.8	V
	4		5		–	–	–	–	–	1.7	–	–	
	4		8		–	1.7	–	–	–	–	–	–	
* V_{CE}(sat)[a]			4	0.4	–	–	–	–	–	–	–	1.1	V
			10	2	–	–	–	2.5	–	2.5	–	–	
			16	3.2	–	2.5	–	–	–	–	–	–	
$I_{S/b}$[b] (t ≥ 1 s)	60				–	–	–	–	–	–	1.2	–	A
f_{hfe}	4		1		–	–	–	–	–	–	10	–	kHz
* h_{fe}	4	f=1kHz	0.5		15	–	15	–	15	–	15	120	
* $\lvert h_{fe} \rvert$	4	f= 0.1MHz	0.5		8	28	8	28	8	28	2	–	
$R_{\theta JC}$					–	1.67	–	1.67	–	1.67	–	1.67	°C/W
$R_{\theta JA}$					–	70	–	70	–	70	–	70	

*2N-series types in accordance with JEDEC registration data format (JS-6, RDF-2)

[a] Pulsed, pulse duration = 300 μs, duty factor = 0.018

2N6098-2N6103, RCA3055

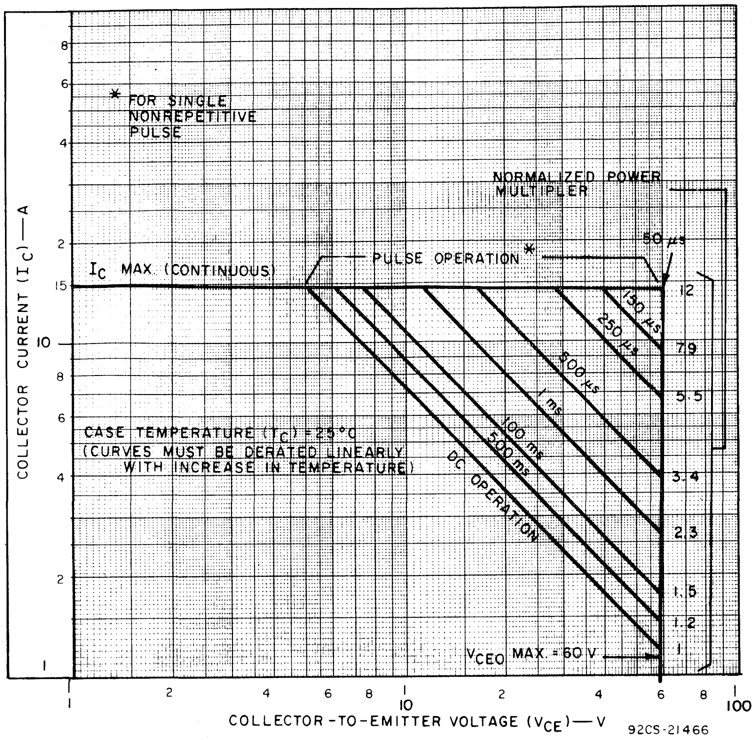


Fig. 4 — Maximum operating areas for RCA3055.

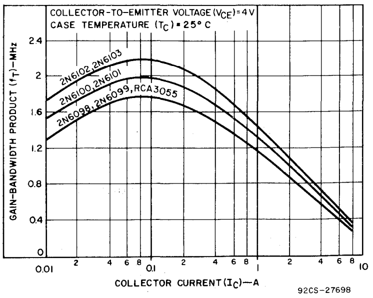


Fig. 5 — Typical gain-bandwidth product for all types.

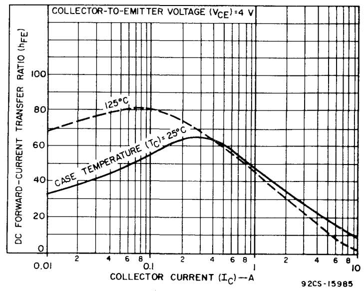


Fig. 6 — Typical dc beta characteristics for 2N6098, 2N6099, and RCA3055.

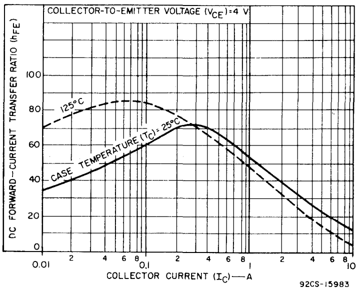


Fig. 7 — Typical dc beta characteristics for 2N6100 and 2N6101.

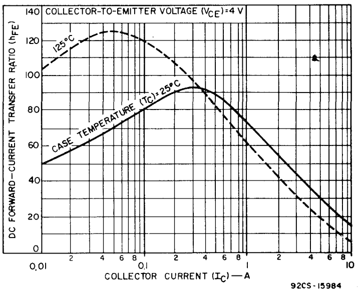


Fig. 8 - Typical dc beta characteristics for 2N6102 and 2N6103.

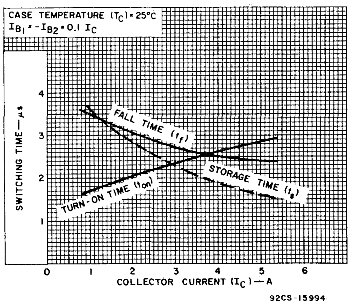


Fig. 9 - Typical saturated switching characteristics for all types.

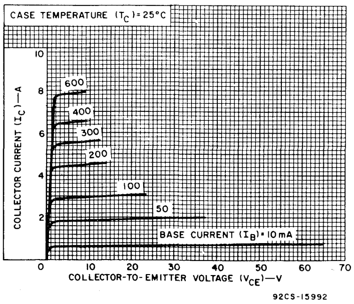


Fig. 10 - Typical output characteristics for 2N6098, 2N6099, and RCA3055.

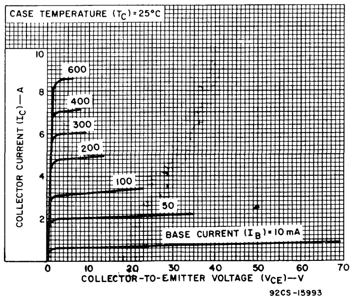


Fig. 11 - Typical output characteristics for 2N6100 and 2N6101.

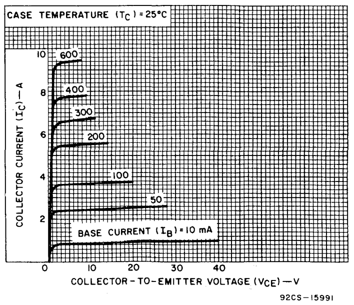


Fig. 12 - Typical output characteristics for 2N6102 and 2N6103.

2N6106-2N6111, 2N6288-2N6293, 2N6473-2N6476, 41500, 41501

Epitaxial-Base, Silicon N-P-N and P-N-P VERSAWATT Transistors

General-Purpose Medium-Power Types for Switching and Amplifier Applications

RCA 2N6106-2N6111, 2N6288-2N6293, and 2N6473-2N6476, 41500 and 41501 are epitaxial-base silicon transistors supplied in a VERSAWATT package. The 2N6288-2N6293, 2N6473, 2N6474, and 41500 are n-p-n complements of p-n-p types 2N6106-2N6111, 2N6475, 2N6476, and 41501, respectively. All these transistors are intended for a wide variety of medium-power switching and amplifier applications, such as series and shunt regulators and driver and output stages of high-fidelity amplifiers.

The 2N6289, 2N6291, and 2N6293 n-p-n types and 2N6106, 2N6108, and 2N6110 p-n-p devices fit into TO-66 sockets. The remaining types are supplied in the JEDEC TO-220AB straight-lead version of the VERSAWATT package. All of these devices are also available on special order in a variety of lead-form configurations. Detailed information on these and other VERSAWATT outlines is contained in "RCA's Lineup of Power Transistors" (PSP-704).

Features:

- **Low saturation voltages**
- **VERSAWATT package (molded silicone plastic)**
- **Complementary n-p-n and p-n-p types**
- **Thermal-cycling ratings**
- **Maximum safe-area-of-operation curves specified for dc operation**

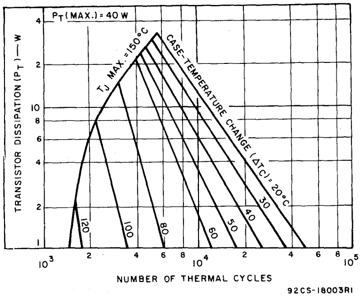
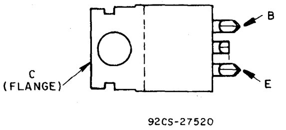
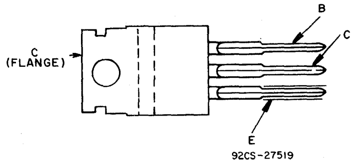


Fig. 1 - Thermal-cycling ratings for all types.

TERMINAL DESIGNATIONS



JEDEC TO-220AA
2N6106, 2N6108, 2N6110
2N6289, 2N6291, 2N6293



JEDEC TO-220AB
2N6107, 2N6109, 2N6111,
2N6288, 2N6290, 2N6292,
2N6473, 2N6474, 2N6475,
2N6476, 41500, 41501

BOTTOM VIEW

MAXIMUM RATINGS, *Absolute-Maximum Values:*	N-P-N	2N6288 2N6289	2N6290 2N6291	2N6292 2N6293	2N6473	2N6474	41500	
	P-N-P	2N6110♦ 2N6111♦	2N6108♦ 2N6109♦	2N6106♦ 2N6107♦	2N6475♦	2N6476♦	41501♦	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	40	60	80	110	130	35	V
*COLLECTOR-TO-EMITTER VOLTAGE:								
With external base-supply resistance (R_{BB}) = 100Ω, and base supply voltage (V_{BB}) = 0	V_{CEX}	40	60	80	110	130	35	V
With base open	V_{CEO}	30	50	70	100	120	25	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	5	5	5	5	3	V
*COLLECTOR CURRENT (Continuous)								
At case temperature ⩽ 106°C	I_C	7	7	7	4	4	7	A
*BASE CURRENT (Continuous)								
At case temperature ⩽ 130°C	I_B	3	3	3	2	2	3	A
TRANSISTOR DISSIPATION:	P_T							
At case temperatures up to 25°C		40	40	40	40	40	40	W
* At case temperatures up to 100°C		16	16	16	16	16	16	W
At ambient temperatures up to 25°C		1.8	1.8	1.8	1.8	1.8	1.8	W
At case temperatures above 25°C		Derate linearly at 0.32 W/°C						
* At case temperatures above 100°C		Derate lineraly at 0.32 W/°C						
At ambient temperatures above 25°C		Derate linearly at 0.0144 W/°C						
*TEMPERATURE RANGE:								
Storage and Operating (Junction)		–65 to 150						°C
*LEAD TEMPERATURE (During Soldering):								
At distance ⩾ 1/8 in. (3.17 mm) from case for 10 s max.		235						°C

* 2N-Series types in accordance with JEDEC registration data format (JS-6, RDF-2)

♦ For p-n-p devices, voltage and current values are negative

2N6106-2N6111, 2N6288-2N6293, 2N6473-2N6476, 41500, 41501

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

	CHARACTERISTIC	SYMBOL	TEST CONDITIONS◆				LIMITS				UNITS
			VOLTAGE V dc		CURRENT A dc		2N6288 2N6289		2N6110◆ 2N6111◆		
			V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	
	Collector-Cutoff Current: With external base-to-emitter resistance (R_{BE}) = 100 Ω	I_{CER}	35				–	0.1	–	–0.1	mA
	With (R_{BE}) = 100 Ω and T_C = 150°C		30				–	2	–	–2	
*	With base-emitter junction reverse-biased	I_{CEX}	37.5	–1.5			–	0.1	–	–0.1	mA
*	With base-emitter junction reverse-biased and T_C = 150°C		30	–1.5			–	2	–	–2	
*	With base open	I_{CEO}	20			0	–	1	–	–1	mA
*	Emitter-Cutoff Current	I_{EBO}		5	0		–	1	–	–1	mA
*	Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$			0.1^a	0	30	–	–30	–	V
	With external base-to emitter resistance (R_{BE}) = 100 Ω	$V_{CER}(sus)$			0.1		40	–	–40	–	V
*	DC Forward Current Transfer Ratio	h_{FE}	4 4		3^a 7^a		30 2.3	150 –	30 2.3	150 –	
*	Base-to-Emitter Voltage: 2N6288, 2N6289 All Types	V_{BE}	4 4		3^a 7^a		– –	1.5 3	– –	– 3	V
*	Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$			3^a 7^a	0.3 3	– –	1 3.5	– –	–1 –3.5	V
*	Common-Emitter, Small-Signal, Forward-Current Transfer Ratio: f = 50 kHz	h_{fe}	4		0.5		20	–	20	–	
	Gain-Bandwidth Product: 2N6288-2N6289 2N6110-2N6111	f_T	4 –4		0.5 –0.5		4 –	– –	– 10	– –	MHz
*	Magnitude of Common-Emitter, Small-Signal, Forward-Current Transfer Ratio: f = 1 MHz 2N6288-2N6289 2N6110-2N6111	$\|h_{fe}\|$	4 –4		0.5 –0.5		4 –	– –	– 10	– –	
*	Collector-to-Base Capacitance: f = 1 MHz, V_{CB} = 10 V	C_{obo}			0		–	250	–	250	pF
	Thermal Resistance: Junction-to-Case	$R_{\theta JC}$					–	3.125	–	3.125	°C/W
	Junction-to-Ambient	$R_{\theta JA}$					–	70	–	70	

[a] Pulsed: Pulse duration = 300 μs, duty factor = 0.018.

◆For p-n-p devices, voltage and current values are negative.

*In accordance with JEDEC registration data format (JS-6 RDF-2).

CAUTION: The sustaining voltage $V_{CER}(sus)$ MUST NOT be measured on a curve tracer.

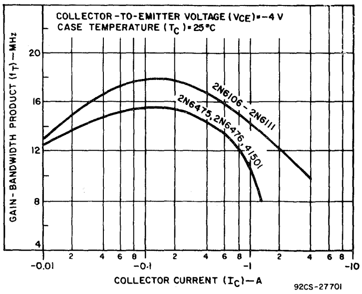


Fig. 2 - Typical gain-bandwidth product for 2N6106–2N6111, 2N6475, 2N6476, and 41501.

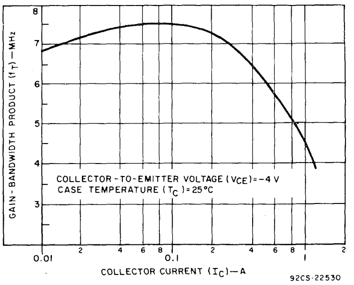


Fig. 3 - Typical gain-bandwidth product for 2N6473 and 2N6474.

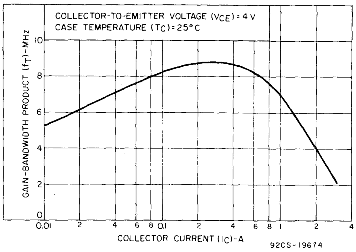


Fig. 4 - Typical gain-bandwidth product for 2N6288–2N6293, and 41500.

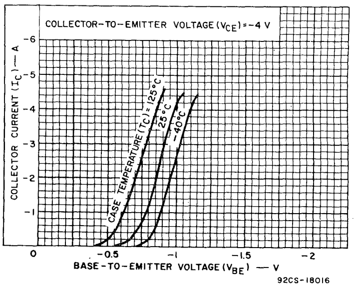


Fig. 5 - Typical transfer characteristics for 2N6106–2N6111.

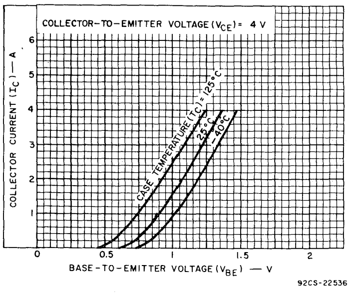


Fig. 6 - Typical transfer characteristics for 2N6473 and 2N6474.

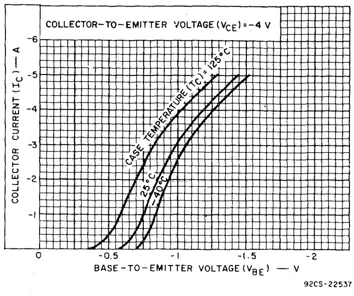


Fig. 7 - Typical transfer characteristics for 2N6475 and 2N6476.

2N6106-2N6111, 2N6288-2N6293, 2N6473-2N6476, 41500, 41501

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS◆				LIMITS				UNITS
	VOLTAGE V dc		CURRENT A dc		2N6292 2N6293 2N6106◆ 2N6107◆		2N6290 2N6291 2N6108◆ 2N6109◆		
	V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	
I_{CER} (R_{BE} = 100Ω)	75				–	0.1	–	–	mA
	55				–	–	–	0.1	
(T_C = 150°C)	70				–	2	–	–	
	50				–	–	–	2	
* I_{CEX}	75	−1.5			–	0.1	–	–	mA
	56	−1.5			–	–	–	0.1	
* (T_C = 150°C)	70	−1.5			–	2	–	–	
	50	−1.5			–	–	–	2	
* I_{CEO}	40			0	–	–	–	1	mA
	60			0	–	1	–	–	
* I_{EBO}		−5	0		–	1	–	1	mA
* V_{CEO}(sus)			0.1^a	0	70	–	50	–	V
V_{CER}(sus) (R_{BE} = 100Ω)			0.1		80	–	60	–	V
* h_{FE}	4		2^a		30	150	–	–	
	4		2.5^a		–	–	30	150	
	4		7^a		2.3	–	2.3	–	
* V_{BE} 2N6292, 2N6293	4		2^a		–	1.5	–	–	V
2N6290, 2N6291	4		2.5^a		–	–	–	1.5	
All Types	4		7^a		–	3	–	3	
* V_{CE}(sat)			2^a	0.2	–	1	–	–	V
			2.5^a	0.25	–	–	–	1	
			7^a	3^a	–	3.5	–	3.5	
* h_{fe} (f = 50 kHz)	4		0.5		20	–	20	–	
f_T 2N6290 - 2N6293	4		0.5		4	–	4	–	MHz
2N6106 - 2N6109	−4		-0.5		10	–	10	–	
* $\lvert h_{fe} \rvert$ (f = 1 MHz) 2N6290 - 2N6293	4		0.5		4	–	4	–	
2N6106 - 2N6109	−4		-0.5		10	–	10	–	
* C_{obo} (f = 1 MHz, V_{CB} = 10 V)			0		–	250	–	250	pF
$R_{\theta JC}$					–	3.125	–	3.125	°C/W
$R_{\theta JA}$					–	70	–	70	

^{a}Pulsed; pulse duration = 300 μs, duty factor = 0.018. ◆For p-n-p devices, voltage and current values are negative

* In accordance with JEDEC registration data format (JS-6 RDF-2).

CAUTION: The sustaining voltages V_{CEO}(sus) and V_{CER}(sus) MUST NOT be measured on a curve tracer.

2N6106-2N6111, 2N6288-2N6293, 2N6473- 2N6476, 41500, 41501

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS♦				LIMITS						UNITS
	VOLTAGE V dc		CURRENT A dc		2N6474 2N6476♦		2N6473 2N6475♦		41500 41501♦		
	V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
I_{CER} (R_{BE} = 100Ω)	30				–	–	–	–	–	0.25	mA
	120				–	0.1	–	–	–	–	
	100				–	–	–	0.1	–	–	
(T_C = 100°C)	120				–	2	–	–	–	–	
	100				–	–	–	2	–	–	
* I_{CEX}	120	−1.5			–	0.1	–	–	–	–	mA
	100	−1.5			–	–	–	0.1	–	–	
* (T_C = 100°C)	120	−1.5			–	2	–	–	–	–	
	100	−1.5			–	–	–	2	–	–	
* I_{CEO}	60			0	–	1	–	–	–	–	mA
	50			0	–	–	–	1	–	–	
* I_{EBO}		−5	0		–	1	–	1	–	–	mA
		−3	0		–	–	–	–	–	1	
* V_{CEO}(sus)			0.1[a]	0	120	–	100	–	25	–	V
V_{CER}(sus) (R_{BE} = 100Ω)			0.1		130	–	110	–	35	–	V
* h_{FE}	4		1[a]		–	–	–	–	25	–	
	4		1.5[a]		15	150	15	150	–	–	
	2.5		4[a]		2	–	2	–	–	–	
* V_{BE}	4		1[a]		–	–	–	–	–	1.5	V
	4		1.5[a]		–	2	–	2	–	–	
	2.5		4[a]		–	3.5	–	3.5	–	–	
* V_{CE}(sat)			1[a]	0.1	–	–	–	–	–	1	V
			1.5[a]	0.15	–	1.2	–	1.2	–	–	
			4[a]	2	–	2.5	–	2.5	–	–	
* h_{fe} (f = 50 kHz)	4		0.5		20	–	20	–	20	–	
f_T 41500, 2N6473, 2N6474	4		0.5		4	–	4	–	4	–	MHz
41501, 2N6475, 2N6476	−4		−0.5		10	–	10	–	10	–	
* $\|h_{fe}\|$ (f = 1 MHz) 41500, 2N6473, 2N6474	4		0.5		4	–	4	–	4	–	
41501, 2N6475, 2N6476	−4		−0.5		10	–	10	–	10	–	
* C_{obo} (f = 1 MHz, V_{CB} = 10 V)			0		–	250	–	250	–	250	pF
$R_{\theta JC}$					–	3.125	–	3.125	–	3.125	°C/W
$R_{\theta JA}$					–	70	–	70	–	70	

[a] Pulsed; pulse duration = 300 μs, duty factor = 0.018.

♦For p-n-p devices, voltage and current values are negative.

*2N-series types in accordance with JEDEC registration data format (JS-6 RDF-2).

CAUTION: The sustaining voltage V_{CEO}(sus) and V_{CER}(sus) MUST NOT be measured on a curve tracer.

2N6106-2N6111, 2N6288-2N6293, 2N6473-2N6476, 41500, 41501

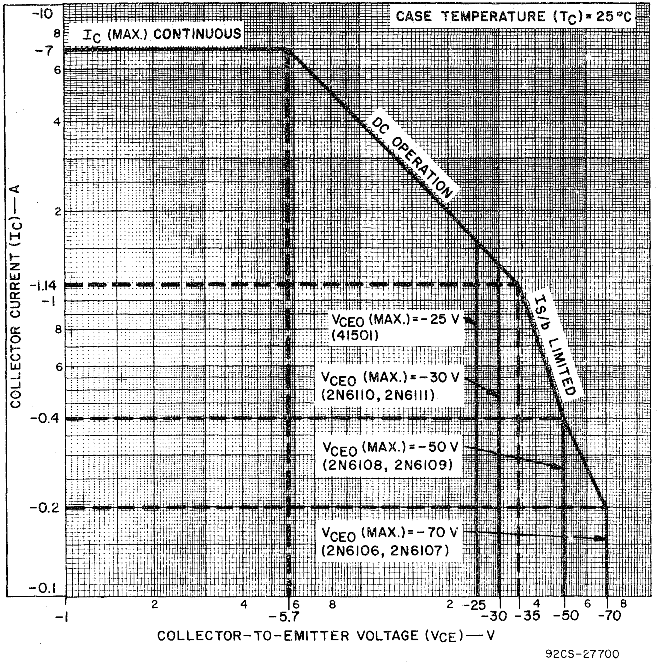


Fig. 8 - Maximum operating areas for 2N6106–2N6111 and 41501.

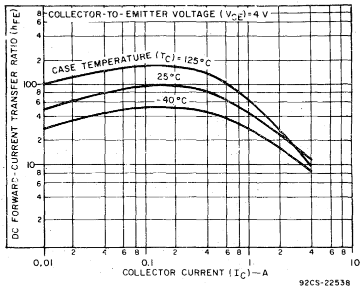


Fig. 9 - Typical dc beta characteristics for 2N6473 and 2N6474.

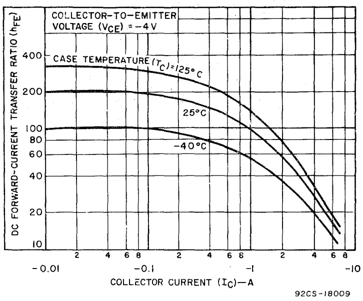


Fig. 10 - Typical dc beta characteristics for 2N6106–2N6111.

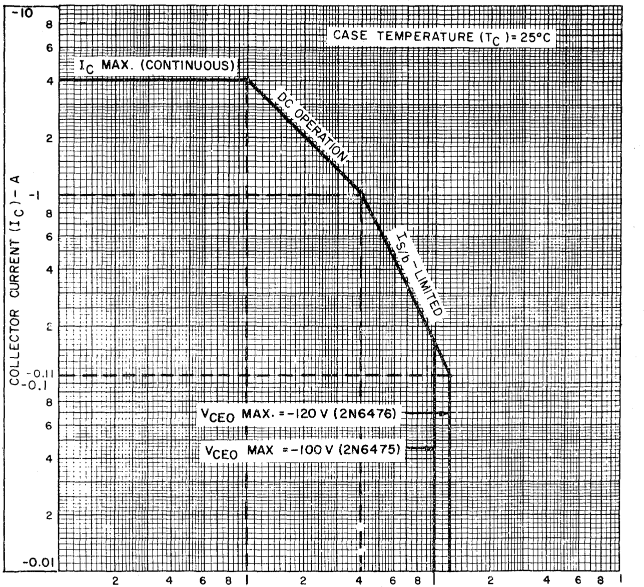


Fig. 11 - Maximum operating areas for 2N6475–2N6476.

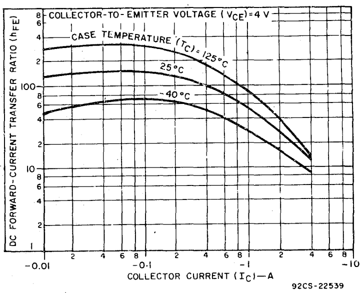


Fig. 12 - Typical dc beta characteristics for 2N6475 and 2N6476.

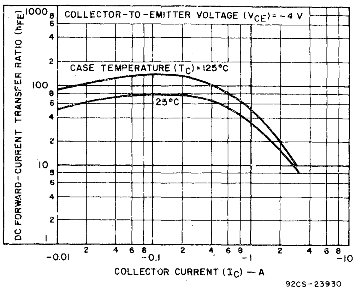


Fig. 13 - Typical dc beta characteristics for 41501.

2N6106-2N6111, 2N6288-2N6293, 2N6473-2N6476, 41500, 41501

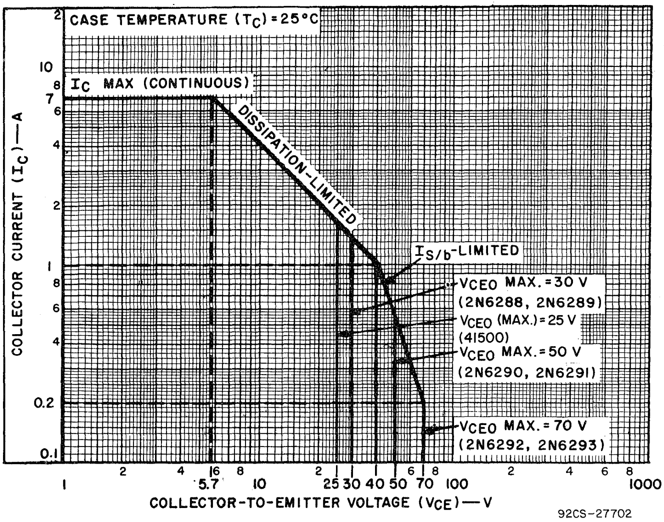


Fig. 14 - Maximum operating areas for 2N6288–2N6293 and 41500.

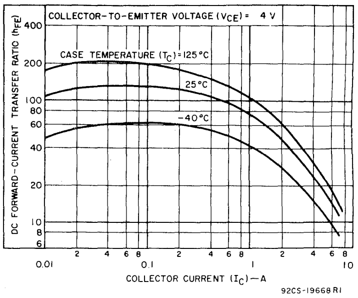


Fig. 15 - Typical dc beta characteristics for 2N6288–2N6293, and 41500.

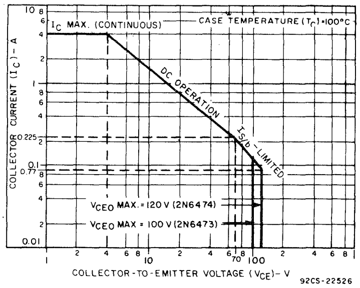


Fig. 16 - Maximum operating areas for 2N6473–2N6474.

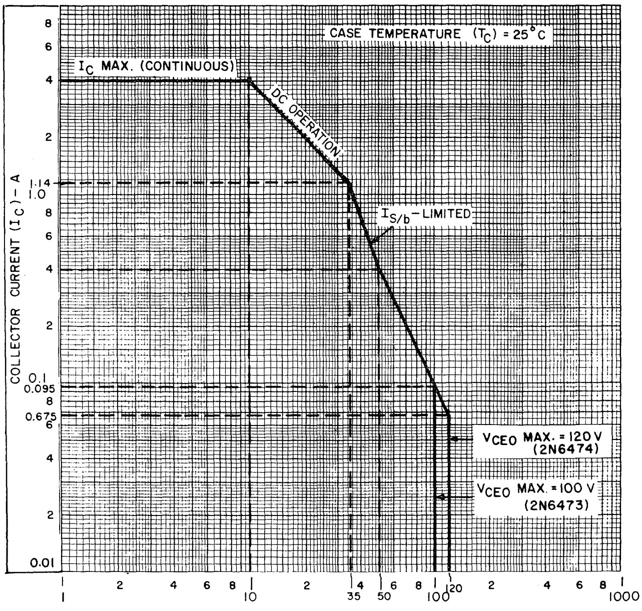


Fig. 17 - Maximum operating areas for 2N6473 and 2N6474.

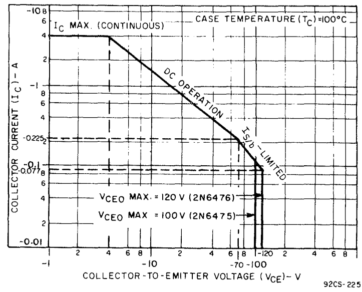


Fig. 18 - Maximum operating areas for 2N6475 and 2N6476.

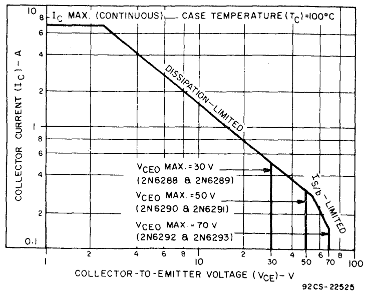


Fig. 19 - Maximum operating areas for 2N6288–2N6293.

2N6106-2N6111, 2N6288-2N6293, 2N6473-2N6476, 41500, 41501

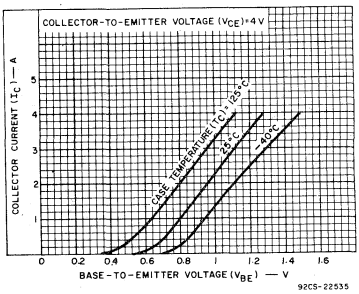


Fig. 20 - Typical transfer characteristics for 2N6288–2N6293, and 41500.

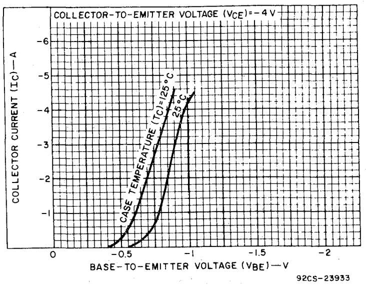


Fig. 21 - Typical transfer characteristics for 41501.

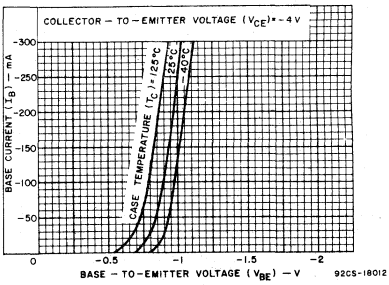


Fig. 22 - Typical input characteristics for 2N6106–2N6111, 2N6475, and 2N6476.

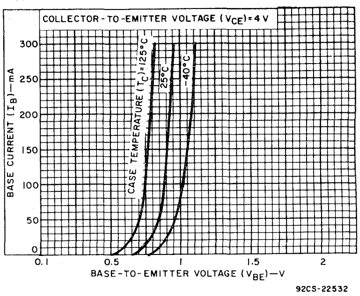


Fig 23 - Typical input characteristics for 2N6473 and 2N6474.

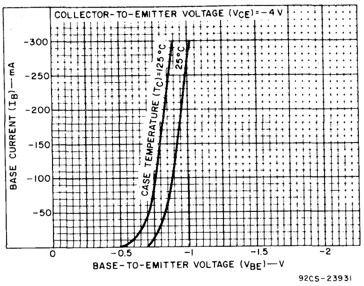


Fig. 24 - Typical input characteristics for 41501.

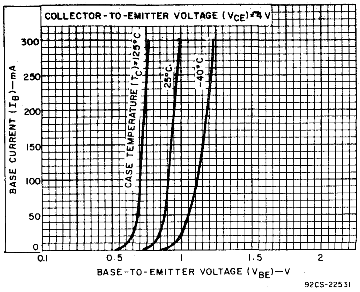


Fig. 25 - Typical input characteristics for 2N6288–2N6293.

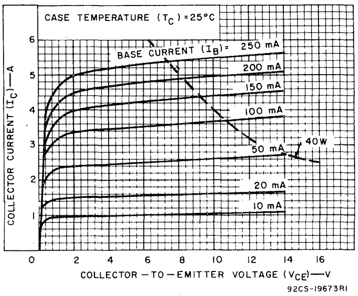


Fig. 26 - Typical output characteristics for 2N6288–2N6293, and 41500.

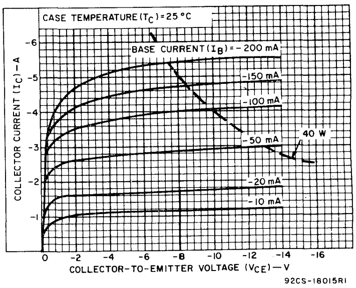


Fig. 27 - Typical output characteristics for 2N6106–2N6111.

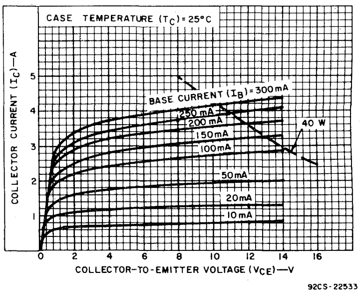


Fig. 28 - Typical output characteristics for 2N6473 and 2N6474.

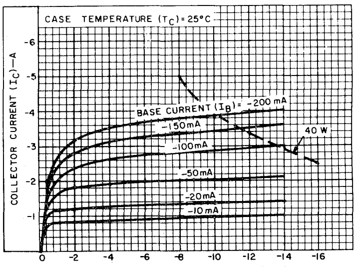


Fig. 29 - Typical output characteristics for 2N6475 and 2N6476.

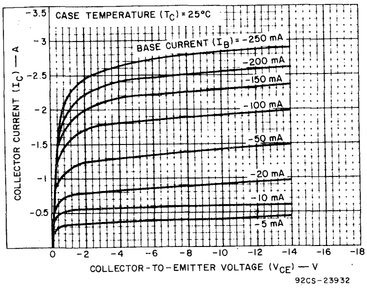


Fig. 30 - Typical output characteristics for 41501.

2N6175-2N6177, 40885-40887, 41505

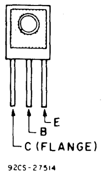
High-Voltage, Medium-Power Silicon N-P-N Transistors

For High-Speed Switching and Linear-Amplifier Applications

RCA types 2N6175, 2N6176, 2N6177 and 41505 are silicon n-p-n transistors with high breakdown voltages, high frequency response, and fast switching speeds. They are supplied in the RCA "Plastic TO-5" package. Types 40885, 40886, and 40887 are electrically identical to the 2N6175-2N6177, respectively, but are supplied with factory-attached heat clips.

Typical applications for these devices include TV video output, RGB output, chroma output, TV blanking, solenoid drivers, off-line inverters, regulators, audio output, and electrostatic deflection in display circuits.

TERMINAL DESIGNATIONS



"Plastic TO-5"

NOTE: Terminal designations are the same for all types, including those with heat clips.

Features:

- **Thermal fatigue ratings**
- **High frequency response: f_T = 20 MHz**
- **Maximum area-of-operation curves for DC and pulse operation**
- **Designed to assure freedom from second breakdown in class A, B, and C operation at maximum ratings**
- **High voltage ratings:**
  V_{CEO}(sus) = 350 V max. (2N6177, 40887)
  = 300 V max. (2N6176, 40886)
  = 250 V max. (2N6175, 40885)
  = 200 V max. (41505)
- **Low saturation voltage**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		2N6175 40885	2N6176 40886	2N6177 40887	41505	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	300	350	450	–	V
*COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE	V_{CEO}(sus)	250	300	350	200	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	6	6	6	7	V
*COLLECTOR CURRENT	I_C	1.0	1.0	1.0	1.0	A
*BASE CURRENT	I_B	0.5	0.5	0.5	0.5	A
*TRANSISTOR DISSIPATION	P_T					
At case temperatures up to 25°C		20	20	20	20	W
			(2N6175, 2N6176, 2N6177, 41505)			
At case temperatures above 25°C			Derate linearly to 135°C			
At ambient temperatures up to 25°C		0.8	0.8	0.8	0.8	W
			(2N6175, 2N6176, 2N6177, 41505)			
		1.4	1.4	1.4	–	W
			(40885, 40886, 40887)			
At ambient temperatures above 25°C			Derate linearly to 135°C			
For pulse operation			See Figs. 4, 7, 10, and 13			
*TEMPERATURE RANGE:						
Storage & Operating (Junction)			–65 to 135			°C
*LEAD TEMPERATURE (During soldering):						
At distance ⩾1/16 in. (1.59 mm) from case for 10 s max. ...			230			°C

*Types 2N6175, 2N6176, and 2N6177 in accordance with JEDEC registration data format JS-9 RDF-8.

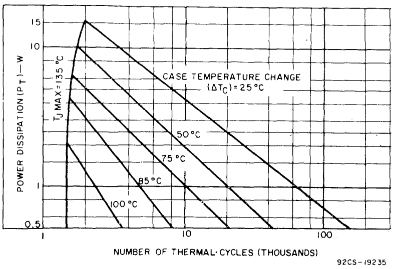


Fig. 1 - Thermal-cycling rating chart for all types.

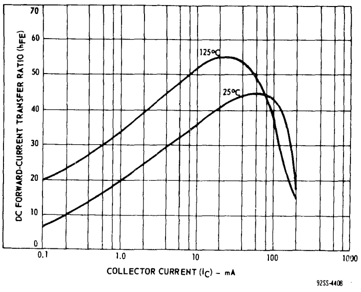


Fig. 2 - Typical dc beta characteristics for all types.

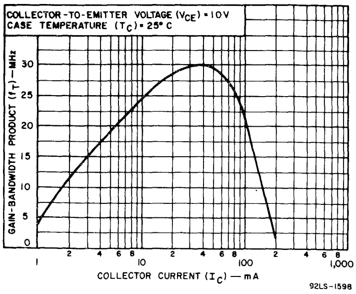


Fig. 3 - Typical gain-bandwidth product for all types.

2N6175-2N6177, 40885-40887, 41505

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	TEST CONDITIONS				LIMITS								UNITS
	VOLTAGE V dc		CURRENT mA dc		2N6175 40885		2N6176 40886		2N6177 40887		41505		
	V_{CB}	V_{CE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
I_{CEO}		300		0	–	–	–	–	–	20	–	–	μA
		200		0	–	50	–	50	–	–	–	–	
* I_{CBO}	360				–	–	–	–	–	20	–	–	
	280				–	–	–	50	–	–	–	–	
	240				–	50	–	–	–	–	–	–	
I_{CEV} (V_{BE} = -1.5 V)		450			–	–	–	–	–	500	–	–	
		300			–	500	–	500	–	–	–	–	
I_{CER} (R_{BE} = 100Ω)		150			–	–	–	–	–	–	–	50	
* I_{EBO} (V_{BE} = -6 V)			0		–	20	–	20	–	20	–	–	μA
h_{FE}		10	50[a]		–	–	–	–	30*	150	20	–	
		10	20[a]		30*	190	30*	150	–	–	–	–	
		10	5[a]		–	–	15	–	15	–	10	–	
		10	1[a]		15	–	–	–	–	–	–	–	
V_{CEO}(sus)			10[a]	0	–	–	–	–	–	–	200[b]	–	V
			50[a]	0	250[b]	–	300[b]	–	350[b]	–	–	–	
V_{BE}(sat)			50[a]	4	–	1.3	–	1.3	–	1.3	–	–	V
V_{CE}(sat)			50[a]	4	–	0.5	–	0.5	–	0.5	–	–	V
			50[a]	5	–	–	–	–	–	–	–	2	
* $V_{(BR)CBO}$			1[a]		300	–	350	–	450	–	–	–	V
$V_{(BR)EBO}$			0	1	–	–	–	–	–	–	7	–	V
* h_{fe} (f = 1 kHz)		10	5		25	–	25	–	25	–	–	–	
* $\|h_{fe}\|$ (f = 3 MHz)		20	20		7	–	7	–	7	–	–	–	
* Re(h_{ie}) (f = 1 MHz)		20	20		–	300	–	–	–	–	–	–	Ω
		10	5		–	–	–	300	–	300	–	–	
* C_{cb} (f = 1 MHz)	20				–	8	–	8	–	8	–	8	pF
$I_{S/b}$ (t = 0.4 s nonrepetitive)		150			133	–	133	–	133	–	–	–	mA
$R_{\theta JC}$					–	5.5	–	5.5	–	5.5	–	5.5	
					(2N6175)		(2N6176)		(2N6177)				
$R_{\theta JA}$					–	138	–	138	–	138	–	138	°C/W
					(2N6175)		(2N6176)		(2N6177)		–	–	
					–	78.6	–	78.6	–	78.6	–	–	
					(40885)		(40886)		(40887)		–	–	

* Types 2N6175, 2N6176, and 2N6177 in accordance with JEDEC registration data format JS-9, RDF-8.

[a] Pulsed; pulse duration = 300 μs; duty factor ≤ 2%.

[b] CAUTION: The sustaining voltage V_{CEO}(sus) MUST NOT be measured on a curve tracer.

2N6175-2N6177, 40885-40887, 41505

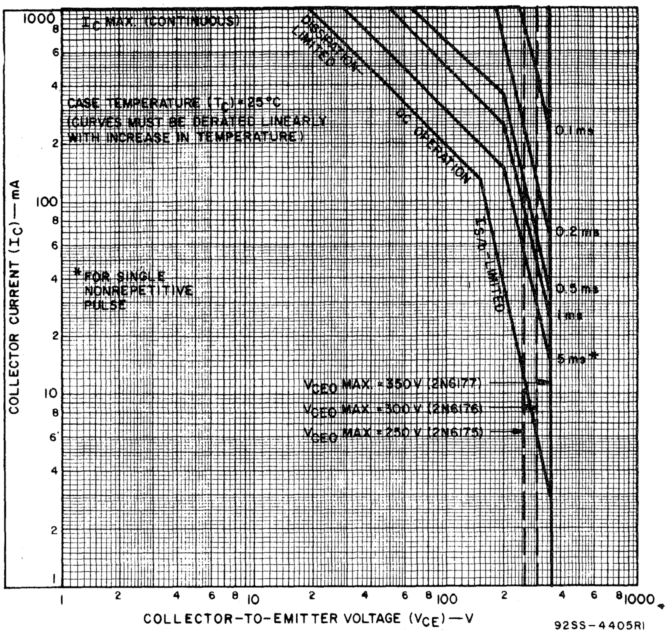


Fig. 4 - Maximum safe-operation-areas for 2N6175, 2N6176, and 2N6177.

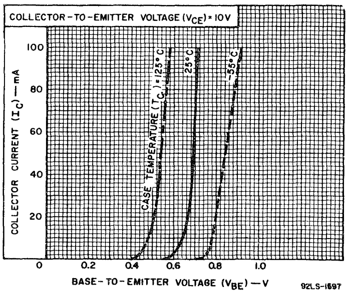


Fig. 5 - Typical transfer characteristics for 2N6175–2N6177 and 40885–40887.

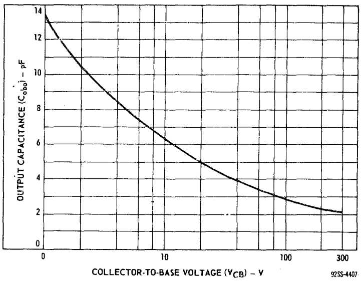


Fig. 6 - Typical output capacitance as a function of collector-to-base voltage for all types.

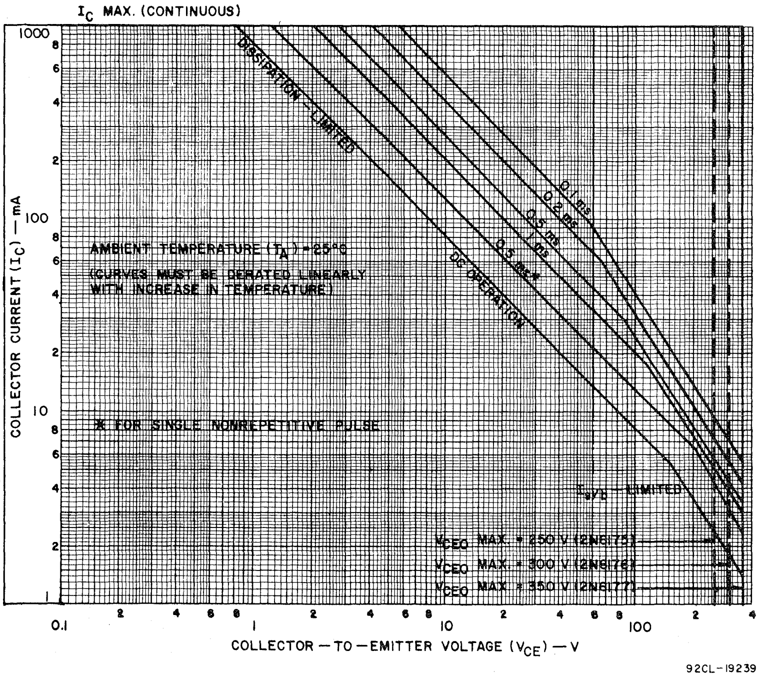


Fig. 7 - Maximum safe area-of-operation at ambient temperature for 2N6175, 2N6176, and 2N6177.

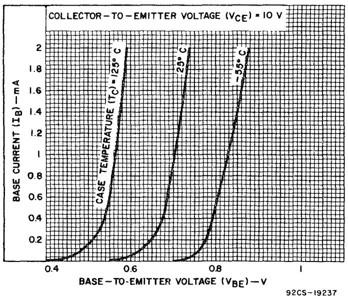


Fig. 8 — Typical input characteristics for 2N6175–2N6177 and 40885–40887.

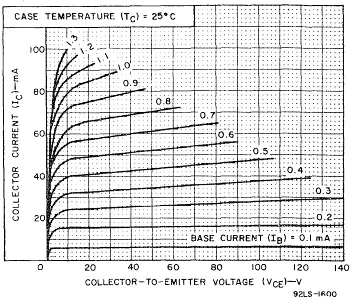
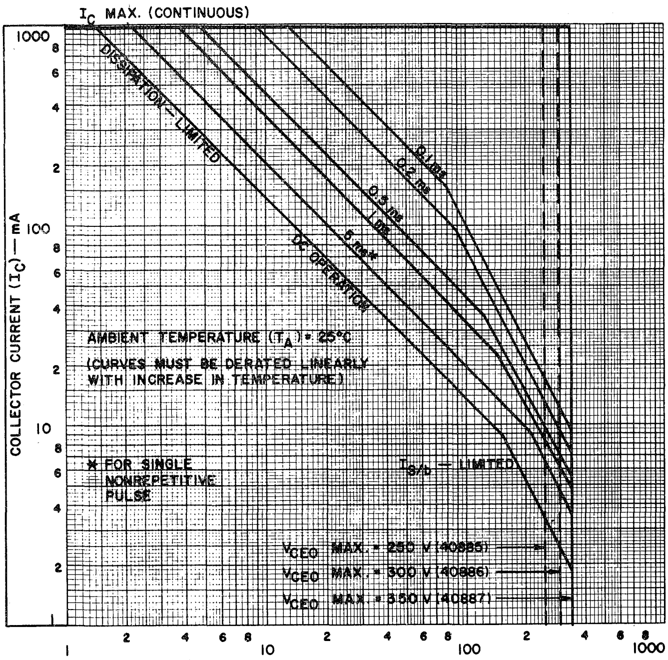


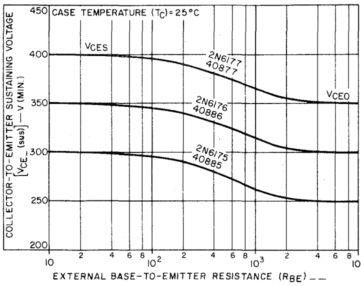
Fig. 9 - Typical output characteristics for 2N6175-2N6177 and 40885-40887.

2N6175-2N6177, 40885-40887, 41505



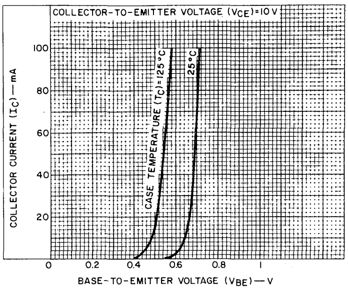
92CS-19236

Fig. 10 - Maximum safe area-of-operation for 40885, 40886, and 40887.



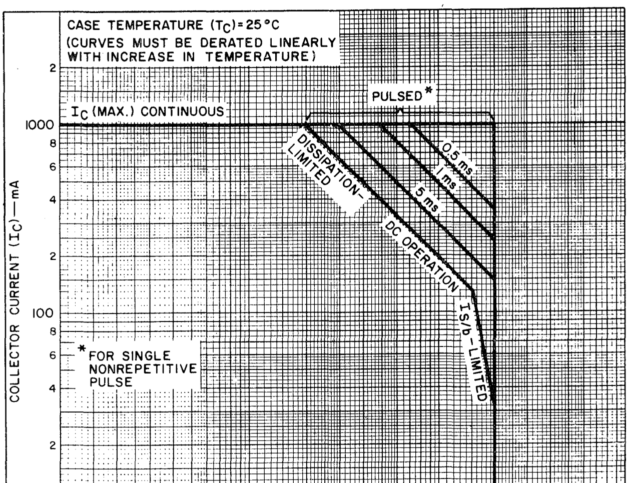
92CS-25088

Fig. 11 - Sustaining voltage as a function of base-to-emitter resistance for 2N6175-2N6177 and 40885-40887.



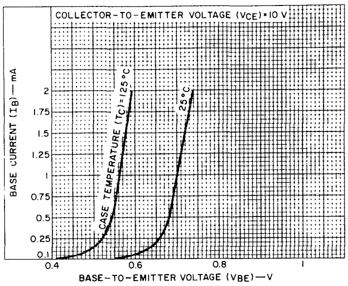
92CS-23966

Fig. 12 - Typical transfer characteristics for 41505.



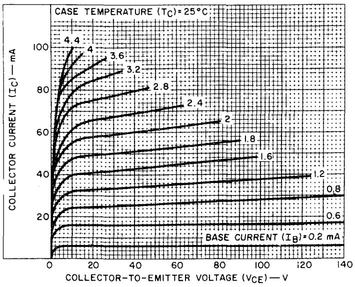
92CS-23963

Fig. 13 - Maximum operating areas for 41505.



92CS-23964

Fig. 14 - Typical input characteristics for 41505.



92CS-23965

Fig. 15 - Typical output characteristics for 41505.

2N6178-2N6181

Complementary N-P-N/P-N-P Silicon Power Transistors

General-Purpose Types for Large-Signal, Medium-Power Applications

RCA types 2N6178, 2N6179, 2N6180, and 2N6181● are silicon power transistors intended for large-signal, medium-power applications in industrial and commercial equipequipment.

The 2N6178 and 2N6179 are silicon n-p-n planar types with features similar to the popular 2N2102. Types 2N6180 and 2N6181 (p-n-p complements of the 2N6178 and 2N6179, respectively) are epitaxial-planar devices with features similar to the 2N4036. All these transistors feature higher collector-current ratings and dissipation capability than their 2N2102/2N4036 counterparts.

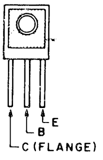
These types are supplied in the "Plastic TO-5" package, which has an insulated mounting hole for ease of mounting and heat sinking.

● Formerly RCA Dev. Nos. TA7554–TA7557, respectively.

Features:

- **2N6180 } P–N–P { 2N6178**
  2N6181 } Complements of: { 2N6179
- **Maximum safe-area-of-operation curves**
- **Planar construction for low-noise and low-leakage characteristics**
- **Low saturation voltage (2N6178, 2N6180)**
- **High beta (2N6179, 2N6181)**

TERMINAL DESIGNATIONS



"Plastic TO-5"

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	2N6179	2N6181	2N6178	2N6180	
* V_{CBO}	75	–75	100	–100	V
* V_{CEX}					
V_{BE} = 1.5 V reverse bias	75	–75	100	–100	V
V_{CER}(sus)					
R_{BE} = 100 Ω	65	–65	90	–90	V
V_{CEO}(sus)	50	–50	75	–75	V
* V_{EBO}	5	–5	7	–7	V
* I_C	2	–2	2	–2	A
* I_B	1	–1	1	–1	A
* P_T:					
$T_C \leqslant 25^oC$	25	25	25	25	W
$> 25^oC$	See Figs.1,2,&7				
$\leqslant 100^oC$	10	10	10	10	W
$> 100^oC$	See Figs.3,4, &7				
* T_J	–65 to 150				^oC
* T_L					
During soldering, at distance ⩾ 1/32 in (0.8 mm) from seating plane for 10 s max.	230				^oC

* In accordance with JEDEC registration data format JS-6/RDF-1.

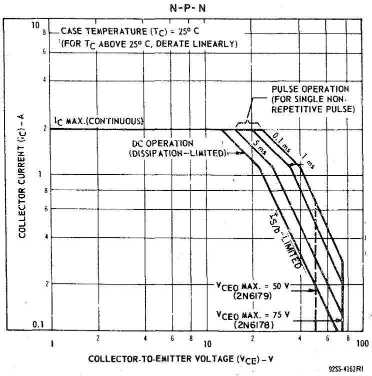


Fig.1 — Maximum operating areas for 2N6178 and 2N6179 at $T_C = 25^oC$.

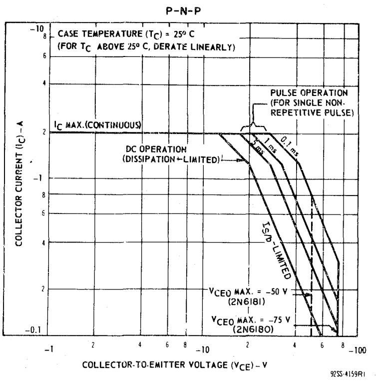


Fig.2 — Maximum operating areas for 2N6180 and 2N6181 at $T_C = 25^oC$.

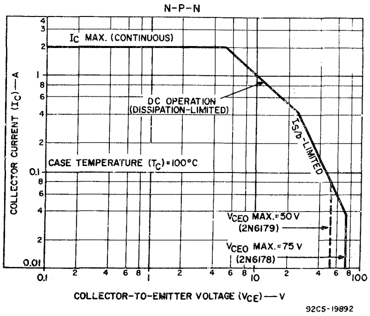


Fig.3 — Maximum operating areas for 2N6178 and 2N6179 at $T_C = 100^oC$.

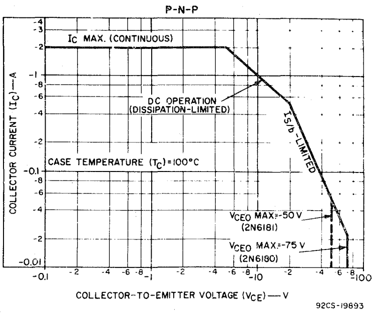


Fig.4 — Maximum operating areas for 2N6180 and 2N6181 at $T_C = 100^oC$.

2N6178-2N6181

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	TEST CONDITIONS♦					LIMITS				UNITS
	VOLTAGE V dc			CURRENT mA dc		2N6178 2N6180♦		2N6179 2N6181♦		
	V_{CB}	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
I_{CBO}	80					–	0.5	–	–	µA
$I_E = 0$	60					–	–	–	0.5	
I_{CEO}		60			0	–	1	–	–	
		45			0	–	–	–	1	
* I_{CEV}		100	−1.5			–	0.1	–	–	mA
		75	−1.5			–	–	–	0.1	
$T_C = 100°C$		70	−1.5			–	0.5	–	–	
		45	−1.5			–	–	–	0.5	
* I_{EBO}			−7	0		–	0.1	–	–	mA
			−5	0		–	–	–	0.1	
$V_{(BR)EBO}$ $I_E = 0.1$ mA				0		7	–	5	–	V
* $V_{(BR)CEV}$			−1.5	0.1		100	–	75	–	V
* $V_{(BR)CEO}$				100	0	75	–	50	–	V
$V_{CER}(sus)^a$ $R_{BE} = 100\ \Omega$				100		90	–	65	–	V
$V_{CEO}(sus)^a$				100	0	75	–	50	–	V
* $V_{CE}(sat)$										
2N6178				500	50	–	0.5	–	–	V
2N6179				500	50	–	–	–	0.8	
2N6180				−500	−50	–	−0.7	–	–	
2N6181				−500	−50	–	–	–	−1.2	
* $V_{BE}(sat)$				500	50	–	1.2	–	1.5	V
C_{obo} f = 1 MHz										
2N6178,2N6179	10					12	20	12	20	pF
2N6180,2N6181	−10					25	40	25	40	
* h_{FE}										
2N6179		4		50		–	–	30	–	
2N6181		−4		−50		–	–	30	–	
2N6178		4		500^b		30	130	–	–	
2N6180		−4		-500^b		30	150	–	–	
2N6179		4		500^b		–	–	40	250	
2N6181		−4		-500^b		–	–	40	250	
2N6178		4		1000^b		10	–	–	–	
2N6180		−4		-1000^b		10	–	–	–	
$I_{S/b}$ t = 0.4s,nonrep.										
2N6178,2N6179		50				200	–	200	–	mA
2N6180,2N6181		−50				−150	–	−150	–	
f_T		4		50		50	–	50	–	MHz
* $\lvert h_{fe} \rvert$ f = 10 MHz		4		50		5	–	5	–	

* In accordance with JEDEC registration data format JS-6/RDF-1.

♦ For p-n-p devices, voltage and current values are negative.

a CAUTION: The sustaining voltages $V_{CEO}(sus)$ and $V_{CER}(sus)$ MUST NOT be measured on a curve tracer.

b Pulsed; pulse duration ⩽ 300 µs, duty factor ⩽ 0.02.

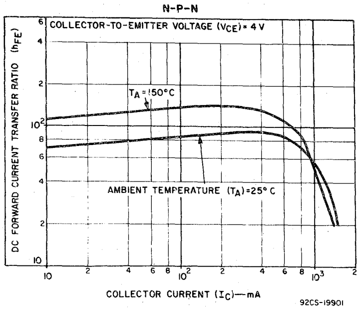


Fig. 5 - Typical dc beta characteristics for 2N6178 and 2N6179.

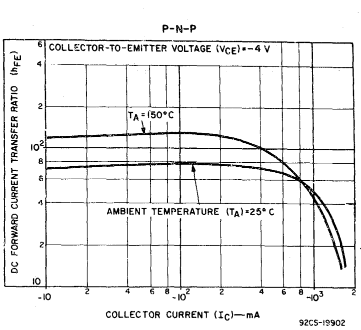


Fig. 6 - Typical dc beta characteristics for 2N6180 and 2N6181.

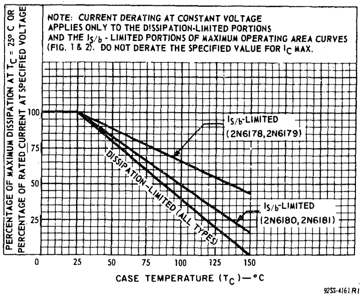


Fig. 7 - Derating curves for all types.

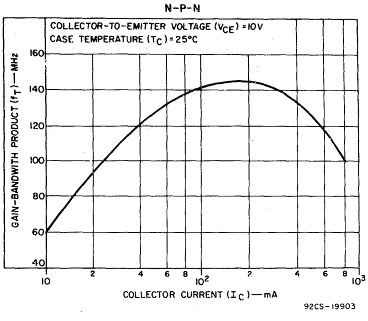


Fig. 8 - Typical gain-bandwidth product for 2N6178 and 2N6179.

2N6178-2N6181

ELECTRICAL CHARACTERISTICS (Cont'd)

CHARACTERISTIC	TEST CONDITIONS					LIMITS				UNITS
	VOLTAGE V dc			CURRENT A dc		2N6178 2N6180◆		2N6179 2N6181◆		
	V_{CB}	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
* t_{ON} V_{CC} = 30 V 2N6178,2N6179 2N6180,2N6181				 500 –500	 50 –50	 – –	 80 100	 – –	 80 100	ns
* t_{OFF} V_{CC} = 30 V 2N6178,2N6179 2N6180,2N6181				 500 –500	 50 –50	 – –	 800 1000	 – –	 800 1000	
$R_{\theta JC}$						–	5	–	5	°C/W
$R_{\theta JA}$						–	156	–	156	

* In accordance with JEDEC registration data format JS-6/RDF-1.

◆ For p-n-p devices, voltage and current values are negative.

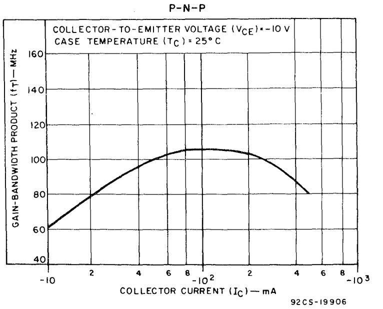


Fig. 9 - Typical gain-bandwidth product for 2N6180 and 2N6181.

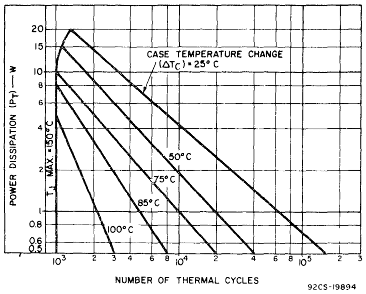


Fig. 10 - Thermal-cycling rating chart for all types.

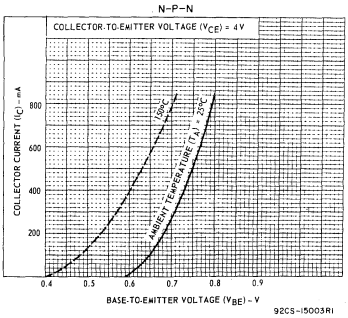


Fig. 11 - Typical transfer characteristics for 2N6178 and 2N6179.

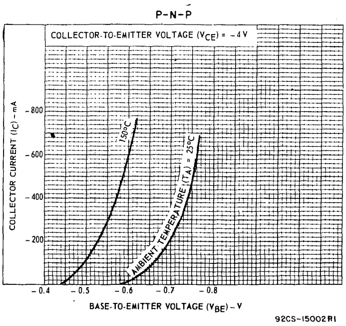


Fig. 12 - Typical transfer characteristics for 2N6180 and 2N6181.

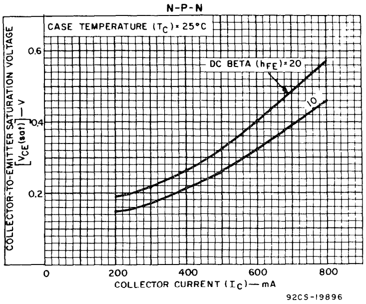


Fig. 13 - Typical saturation-voltage characteristics for 2N6178 and 2N6179.

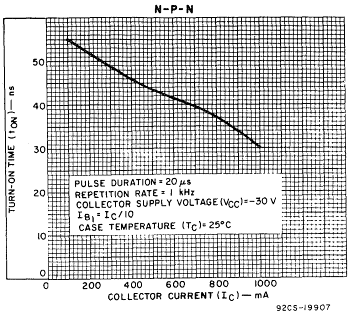


Fig. 14 - Typical turn-on time for 2N6178 and 2N6179.

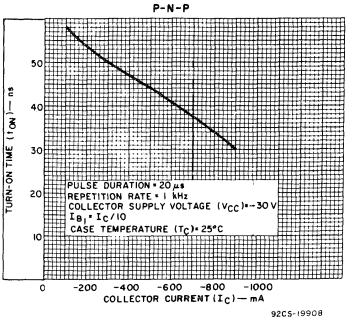


Fig. 15 - Typical turn-on time for 2N6180 and 2N6181.

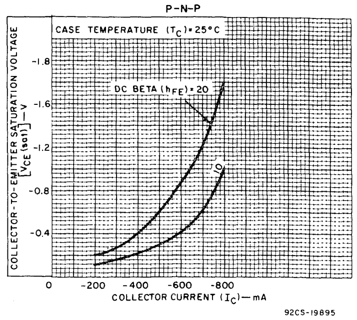


Fig. 16 - Typical saturation-voltage characteristics for 2N6180 and 2N6181.

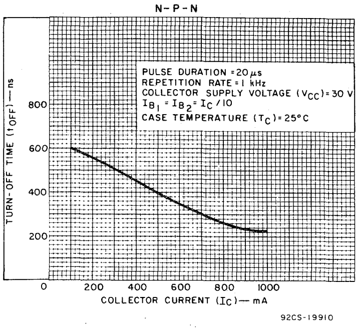


Fig. 17 - Typical turn-off time for 2N6178 and 2N6179.

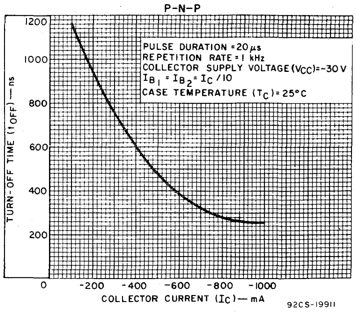


Fig. 18 - Typical turn-off time for 2N6180 and 2N6181.

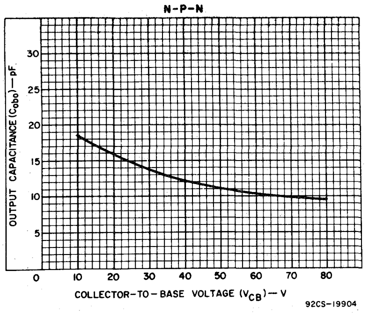


Fig. 19 - Typical output capacitance as a function of collector-to-base voltage for 2N6178 and 2N6179.

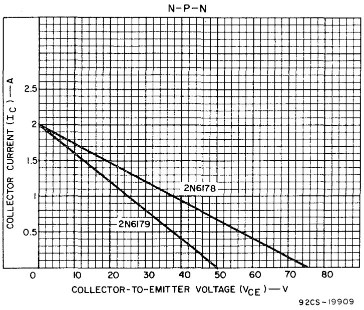


Fig. 20 - Maximum operating conditions, resistive-load switching between saturation and cutoff for 2N6178 and 2N6179.

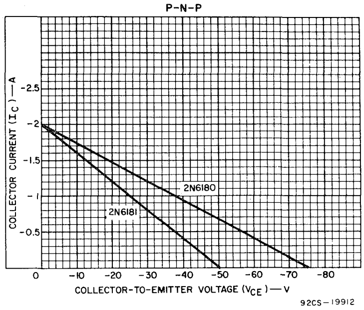


Fig. 21 - Maximum operating conditions, resistive-load switching between saturation and cutoff for 2N6180 and 2N6181.

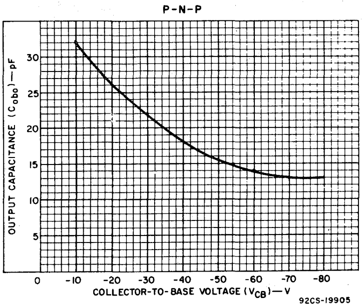


Fig. 22 - Typical output capacitance as a function of collector-to-base voltage for 2N6180 and 2N6181.

2N6211-2N6214

High-Voltage Medium-Power Silicon P-N-P Transistors

For Switching and Amplifier Applications
In Military, Industrial, and Commercial Equipment

Features:

- **High voltage ratings:**
  V_{CEO}(sus) = −400 V max. (2N6214)
  = −350 V max. (2N6213)
  = −300 V max. (2N6212)
  = −225 V max. (2N6211)
- **Large safe-operating area**
- **Complements to 2N3585 transistor family**
- **Thermal-cycling rating**

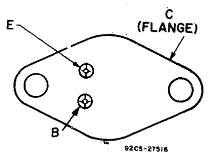
RCA types 2N6211, 2N6212, 2N6213, and 2N6214● are epitaxial silicon p-n-p transistors with high breakdown-voltage ratings and fast switching speeds. They are supplied in the popular JEDEC TO-66 package; they differ in breakdown-voltage ratings and leakage-current values.

● Formerly RCA Dev. Nos. TA7719, TA7410, TA8330, and TA8331, respectively.

Applications:

- **Power-Switching Circuits**
- **Switching Regulators**
- **Converters**
- **Inverters**
- **High-Fidelity Amplifiers**

TERMINAL DESIGNATIONS



JEDEC TO-66

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		2N6211	2N6212	2N6213	2N6214	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	−275	−350	−400	−450	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:						
With base open	V_{CEO}(sus)	−225	−300	−350	−400	V
With external base-to-emitter resistance (R_{BE}) = 50 Ω	V_{CER}(sus)	−250	−325	−375	−425	V
* With base-emitter junction reverse-biased (V_{BE} = 1.5 V)	V_{CEX}(sus)	−275	−350	−400	−450	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	−6	−6	−6	−6	V
*COLLECTOR CURRENT (Continuous)	I_C	−2	−2	−2	−2	A
*BASE CURRENT (Continuous)	I_B	−1	−1	−1	−1	A
TRANSISTOR DISSIPATION:	P_T					
* At case temperatures up to 100°C and V_{CE} up to 50 V		20	20	20	20	W
At case temperatures up to 25°C and V_{CE} up to 40 V		35	35	35	35	W
At case temperatures up to 25°C and V_{CE} above 40 V		See Fig. 1				
At case temperatures above 25°C		Derate linearly to 200°C				
*TEMPERATURE RANGE:						
Storage & Operating (Junction)		← −65 to 200 →				°C
*LEAD TEMPERATURE (During Soldering):						
At distance ≥ 1/32 in. (0.8 mm) from case for 10s max.		← 230 →				°C

*In accordance with JEDEC registration data format (JS-6 RDF-1)

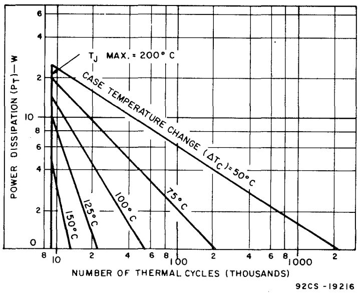


Fig. 2 - Thermal-cycling rating chart for all types.

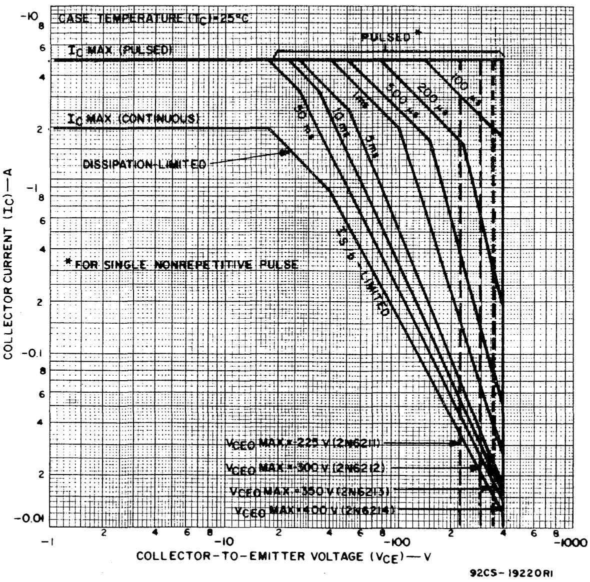


Fig. 1 - Maximum operating areas for all types.

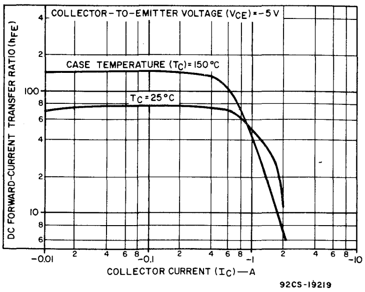


Fig. 3 - Typical dc beta characteristic for all types.

ELECTRICAL CHARACTERISTICS, At Case Temperature (T_C) = 25°C Unless Otherwise Specified

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS								UNITS
		Voltage V dc		Current A dc		2N6211		2N6212		2N6213		2N6214,		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Collector-Cutoff Current: With base open	I_{CEO}	-150			0	–	-5	–	-5	–	-5	–	-5	mA
• With base-emitter junction reverse-biased	I_{CEV}	-250 -315 -360 -410	1.5 1.5 1.5 1.5			– – – –	-0.5 – – –	– – – –	– -0.5 – –	– – – –	– – -0.5 –	– – – –	– – – -1	
• With base-emitter junction reverse biased and T_C = 100°C		-250 -315 -360 -410	1.5 1.5 1.5 1.5			– – – –	-5 – – –	– – – –	– -5 – –	– – – –	– – -5 –	– – – –	– – – -10	
• Emitter-Cutoff Current	I_{EBO}		6	0		–	-1	–	-0.5	–	-0.5	–	-0.5	mA
• DC Forward-Current Transfer Ratio	h_{FE}	-2.8 -3.2 -4 -5		-1[a] -1[a] -1[a] -1[a]		10 – – –	100 – – –	– 10 – –	– 100 – –	– – 10 –	– – 100 –	– – – 10	– – – 100	
• Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$			-0.2[a]	0	-225	–	-300	–	-350	–	-400		V
With external base-to-emitter resistance (R_{BE}) = 50 Ω	$V_{CER}(sus)$			-0.2[a]		-250		-325	–	-375	–	-425		
With base-emitter junction reverse-biased and external base-to-emitter resistance (R_{BE}) - 50 Ω	$V_{CEX}(sus)$		1.5	-0.2[a]		275	–	-350	–	-400	–	-450	–	
• Emitter-to-Base Voltage	V_{EBO}				0.5 mA 1 mA	 6	–	-6	–	-6 –	– –	-6 –	– –	V
• Emitter-to-Base Saturation Voltage	$V_{BE}(sat)$			-1[a]	-0.125	–	1.4	–	-1.4	–	-1.4	–	-1.4	V
• Collector to-Emitter Saturation Voltage	$V_{CE}(sat)$			-1[a]	-0.125	–	1.4	–	-1.6	–	-2	–	-2.5	V
Output Capacitance (f - 1 MHz)	C_{obo}	-10 (V_{CB})				–	220	–	220	–	220	–	220	pF
Second-Breakdown Collector Current (Base forward-biased)	$I_{S/b}$	-40				-0.875	–	-0.875	–	-0.875	–	-0.875	–	A
• Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f = 5 MHz)	$\|h_{fe}\|$	-10		-0.2		4	–	4	–	4	–	4	–	
• Saturated Switching Times: Rise time	t_r	V_{CC} = -200 V		-1	I_{B1} & I_{B2} -0.125	–	0.6	–	0.6	–	0.6	–	0.6	μs
Storage time	t_s	V_{CC} = -200 V		-1	I_{B1} & I_{B2} -0.125	–	2.5	–	2.5	–	2.5	–	2.5	
Fall time	t_f	V_{CC} = -200 V		-1	I_{B1} & I_{B2} -0.125	–	0.6	–	0.6	–	0.6	–	0.6	
Thermal Resistance (Junction-to-case)	$R_{\theta JC}$	-10		-1		–	5	–	5	–	5	–	5	°C/W

• In accordance with JEDEC registration data format JS-6 RDF-1.

[a] Pulsed, pulse duration = 300 μs; duty factor ≤ 2%.

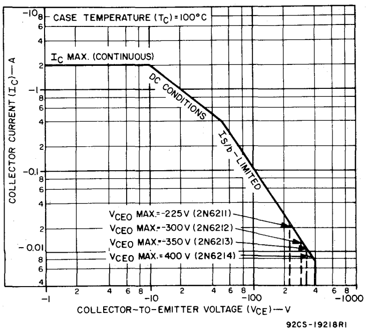


Fig. 4 - Maximum operating areas for all types.

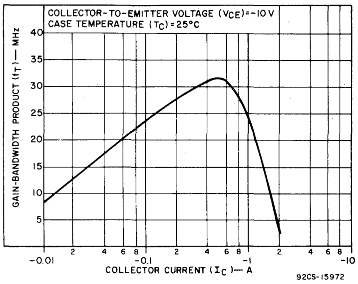


Fig. 5 - Typical gain-bandwidth product for all types.

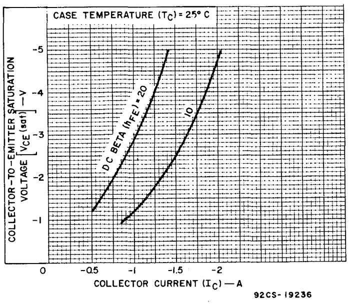


Fig. 6 - Typical saturation-voltage characteristics for all types.

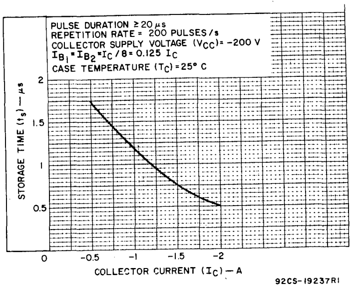


Fig. 7 - Typical storage-time characteristic for all types.

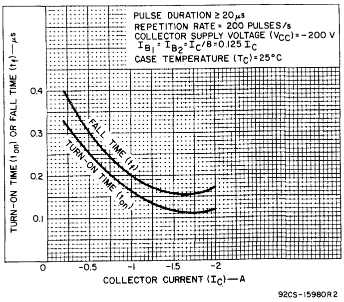


Fig. 8 - Typical turn-on time and fall-time characteristics for all types.

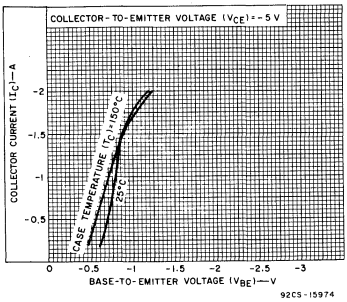


Fig. 9 - Typical transfer characteristics for all types.

2N6246, 2N6247, 2N6248, 2N6469, 2N6470, 2N6471, 2N6472

Silicon N-P-N and P-N-P Epitaxial-Base High-Power Transistors

General-Purpose Types for Switching and Linear-Amplifier Applications

RCA-2N6246, 2N6247, 2N6248, and 2N6469▲ are epitaxial-base silicon p-n-p transistors featuring high gain at high current. RCA-2N6470, 2N6471, and 2N6472● are epitaxial-base silicon n-p-n transistors. They may be used as complements to the 2N6469, 2N6246, and 2N6247, respectively. All of these devices have a dissipation capability of 125 watts at case temperatures up to 25°C. They differ in voltage ratings and in the currents at which the parameters are controlled. All are supplied in the JEDEC TO-3 package.

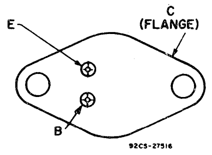
▲ Formerly RCA Dev. Nos. TA7281, TA7280, TA7279, and TA8724, respectively.

● Formerly RCA Dev. Nos. TA8726, TA8443, and TA8442, respectively.

Features:

- High dissipation capability: 125 W at 25°C
- Low saturation voltages
- Maximum safe-area-of-operation curves
- Hermetically sealed JEDEC TO-3 package
- High gain at high current
- Thermal-cycling rating curve

TERMINAL DESIGNATIONS



JEDEC TO-3

Maximum Ratings, *Absolute-Maximum Values:*

		N-P-N 2N6470	2N6471	2N6472		
		P-N-P **2N6469◆**	**2N6246◆**	**2N6247◆**	**2N6248◆**	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	50	70	90	110	V
COLLECTOR-TO-EMITTER VOLTAGE:						
* With external base-to-emitter resistance (R_{BE}) = 100 Ω	V_{CER}	50	70	90	110	V
With base open	V_{CEO}	40	60	80	100	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	5	5	5	V
*CONTINUOUS COLLECTOR CURRENT	I_C	15	15	15	10	A
*CONTINUOUS BASE CURRENT	I_B	5	5	5	5	A
*TRANSISTOR DISSIPATION:	P_T					
At case temperatures up to 25°C		125	125	125	125	W
At case temperatures above 25°C		◄— Derate linearly 200°C —►				
*TEMPERATURE RANGE:						
Storage & Operating (Junction)		◄— −65 to +200 —►				°C
*PIN TEMPERATURE (During Soldering):						
At distances ≥ 1/32" (0.8 mm) from seating plane for 10 s max.		◄— +235 —►				°C

* In accordance with JEDEC registration data format (JS-6 RDF-2).

◆ For p-n-p devices, voltage and current values are negative.

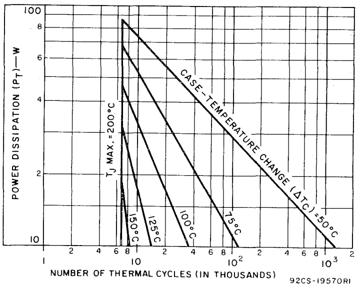


Fig. 1 - Thermal-cycling rating chart for all types.

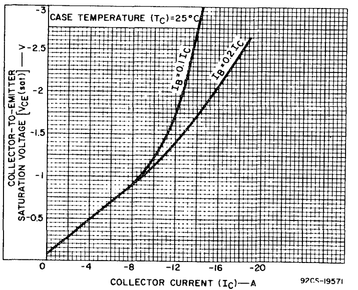


Fig. 2 - Typical collector-to-emitter saturation-voltage characteristics for 2N6246, 2N6247, 2N6248, and 2N6469.

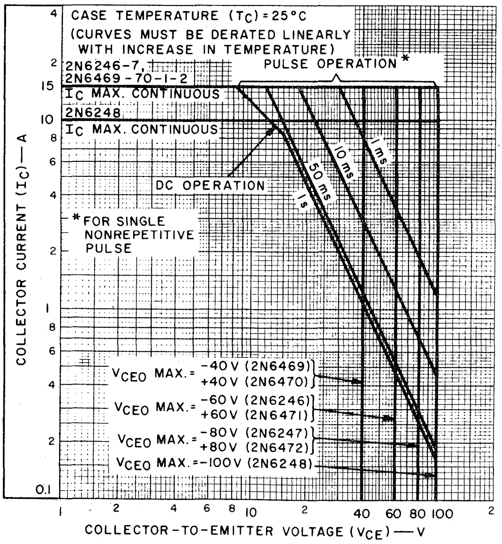


Fig. 3 - Maximum operating areas for all types.◆

◆For p-n-p devices, voltage and current values are negative.

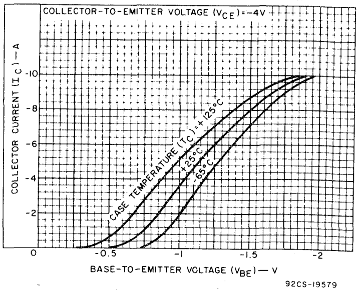


Fig. 4 - Typical transfer characteristics for 2N6246, 2N6247, 2N6248, and 2N6469.

2N6246, 2N6247, 2N6248, 2N6469, 2N6470, 2N6471, 2N6472

ELECTRICAL CHARACTERISTICS FOR N-P-N TYPES, *At case temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS			LIMITS						UNITS
		VOLTAGE V dc	CURRENT A dc		2N6470		2N6471		2N6472		
		V_{CE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
Collector-Cutoff Current: With external base-emitter resistance (R_{BE}) = 100 Ω	I_{CER}	35			–	500	–	–	–	–	µA
		55			–	–	–	500	–	–	
		75			–	–	–	–	–	500	
* With base-emitter junction reverse-biased V_{BE} = −1.5 V	I_{CEX}	45			–	500	–	–	–	–	µA
		65			–	–	–	500	–	–	
		85			–	–	–	–	–	500	
* With reverse bias, V_{BE} = −1.5 V, and T_C = 150°C		40			–	5	–	–	–	–	mA
		60			–	–	–	5	–	–	
		80			–	–	–	–	–	5	
* With base open	I_{CEO}	20		0	–	1	–	–	–	–	mA
		30		0	–	–	–	1	–	–	
		40		0	–	–	–	–	–	1	
* Emitter-Cutoff Current: V_{BE} = −5 V	I_{EBO}		0		–	1	–	1	–	1	mA
* DC Forward-Current Transfer Ratio	h_{FE}	4	5^a		20	150	20	150	20	150	
		4	15^a		5	–	5	–	5	–	
* Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$		0.2	0	40^b	–	60^b	–	80^b	–	V
With external base-emitter resistance (R_{BE}) = 100 Ω	$V_{CER}(sus)$		0.2		50^b	–	70^b	–	90^b	–	
* Base-to-Emitter Voltage	V_{BE}	4	5^a		–	1.3	–	1.3	–	1.3	V
		4	15^a		–	3.5	–	3.5	–	3.5	
* Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$		5^a	0.5	–	1.3	–	1.3	–	1.3	V
			15^a	5	–	3.5	–	3.5	–	3.5	
* Magnitude of Common-Emitter Small-Signal Short-Circuit Forward-Current Transfer Ratio: f = 1 MHz	$\lvert h_{fe} \rvert$	4	1		5	–	5	–	5	–	
* Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio: f = 1 kHz	h_{fe}	4	1		25	–	25	–	25	–	
Thermal Resistance: Junction-to-case	$R_{\theta JC}$				–	1.4	–	1.4	–	1.4	°C/W

* In accordance with JEDEC registration data format (JS-6 RDF-2).

[a] Pulsed; pulse duration = 300 µs, duty factor = 1.8%.

[b] *CAUTION: Sustaining voltages $V_{CEO}(sus)$ and $V_{CER}(sus)$ MUST NOT be measured on a curve tracer.*

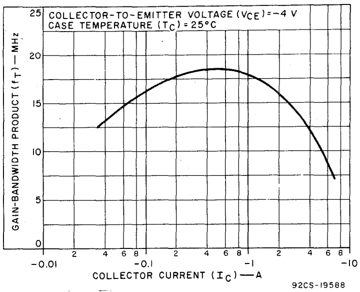


Fig. 5 - Typical gain-bandwidth product as a function of collector current for 2N6246, 2N6247, 2N6248, and 2N6469.

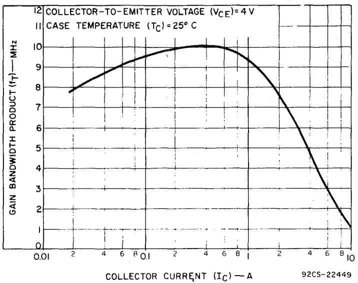


Fig. 6 - Typical gain-bandwidth product as a function of collector current for 2N6470, 2N6471 and 2N6472.

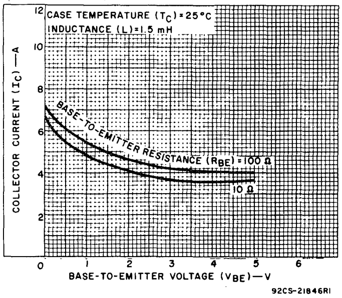


Fig. 7 - Minimum reverse-bias second-breakdown characteristics for all types. (Values for p-n-p types are negative).

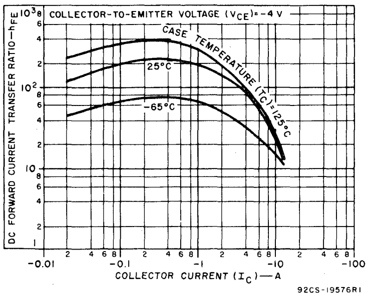


Fig. 8 - Typical dc beta characteristics for 2N6246, 2N6247, and 2N6469.

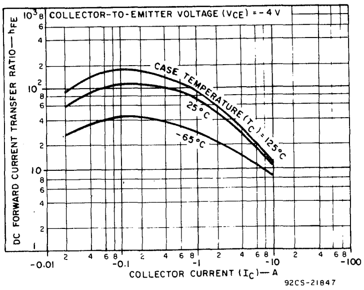


Fig. 9 - Typical dc beta characteristics for 2N6248.

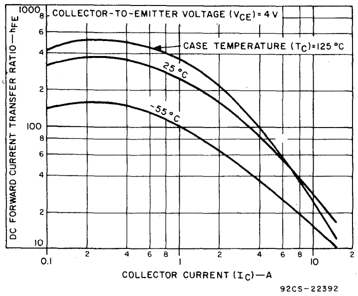


Fig. 10 - Typical dc beta characteristics for 2N6470, 2N6471, and 2N6472.

2N6246, 2N6247, 2N6248, 2N6469, 2N6470, 2N6471, 2N6472

ELECTRICAL CHARACTERISTICS FOR P-N-P TYPES, *At case temperature (T_C) = 25°C unless otherwise specified*

SYMBOL	TEST CONDITIONS				LIMITS				TEST CONDITIONS				LIMITS				UNITS
	VOLTAGE V dc		CURRENT A dc		2N6469		2N6246		VOLTAGE V dc		CURRENT A dc		2N6247		2N6248		
	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
I_{CER} (R_{BE}) = 100 Ω	−35 −55				– –	−200 –	– –	– −200	−75 −95				– –	−200 –	– –	– −200	μA
* I_{CEX}	−45 −65	1.5 1.5			– –	−200 –	– –	– −200	−85 −100	1.5 1.5			– –	−200 –	– –	– −200	μA
* T_C = 150°C	−45 −55	1.5 1.5			– –	−5 –	– –	– −5	−70 −90	1.5 1.5			– –	−5 –	– –	– −5	mA
* I_{CEO}	−20 −30			0 0	– –	−1 –	– –	– −1	−40 −50			0 0	– –	−1 –	– –	– −1	mA
* I_{EBO}		5		0	–	−5	–	−5		5		0	–	−1	–	−1	mA
* h_{FE}	−4 −4 −4		−5[a] −7[a] −15[a]		20 – 5	150 – –	– 20 5	– 100 –	−4 −4 −4 −4		−5[a] −6[a] −10[a] −15[a]		– 20 – 5	– 100 – –	20 – 5 –	100 – – –	
* V_{CEO}(sus)			−0.2	0	−40[b]	–	−60[b]	–			−0.2	0	−80[b]	–	−100[b]	–	V
V_{CER}(sus)			−0.2		−50[b]	–	−70[b]	–			−0.2		−90[b]	–	−110[b]	–	
* V_{BE}	−4 −4		−15[a] −7[a]		– –	−3.5 –	– –	– −2	−4 −4		−6[a] −5[a]		– –	−1.8 –	– –	– −1.8	V
* V_{CE}(sat)			−5[a] −7[a] −15[a] −15[a]	−0.5 −0.7 −5 −3	– – – –	−1.3 – −3.5 –	– – – –	– −1.3 – −2.5			−5[a] −6[a] −15[a] −10[a]	−0.5 −0.6 −4 −2	– – – –	– −1.3 −3.5 –	– – – –	−1.3 – – −3.5	V
* $\|h_{fe}\|$ f = 2 MHz	−4		−1		5	–	5	–	−4		−1		5	–	5	–	
* h_{fe} f = 1 kHz	−4		−1		25	–	25	–	−4		−1		25	–	25	–	
$R_{\theta JC}$					–	1.4	–	1.4					–	1.4	–	1.4	°C/W

* In accordance with JEDEC registration data format (JS-6 RDF-2).

[a] Pulsed; pulse duration = 300 μs, duty factor = 1.8%.

[b] *CAUTION: CAUTION: Sustaining voltages V_{CEO}(sus) and V_{CER}(sus) MUST NOT be measured on a curve tracer. (See Fig. 22)*

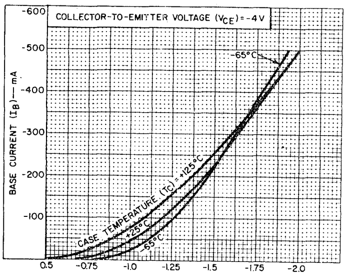


Fig. 11 - Typical input characteristics for 2N6246, 2N6247, and 2N6449.

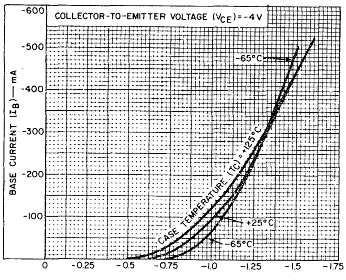


Fig. 12 - Typical input characteristics for 2N6248.

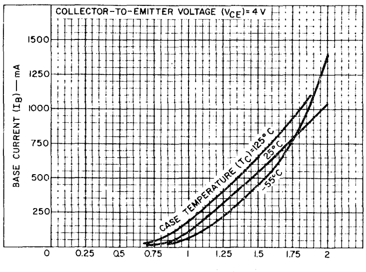


Fig. 13 - Typical input characteristics for 2N6470, 2N6471, and 2N6472.

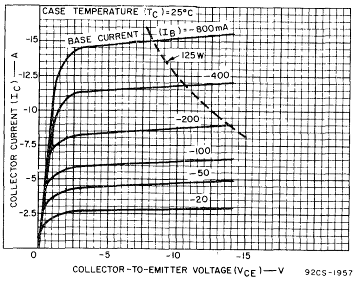


Fig. 14 - Typical output characteristics for 2N6246, 2N6247, and 2N6469.

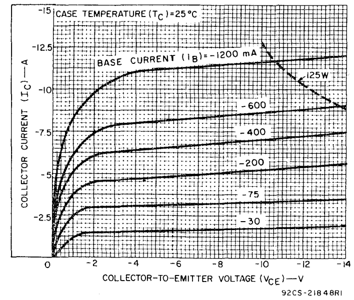


Fig. 15 - Typical output characteristics for 2N6248.

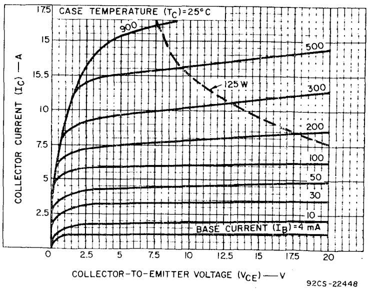


Fig. 16 - Typical output characteristics for 2N6470, 2N6471, and 2N6472.

2N6246, 2N6247, 2N6248, 2N6469, 2N6470, 2N6471, 2N6472

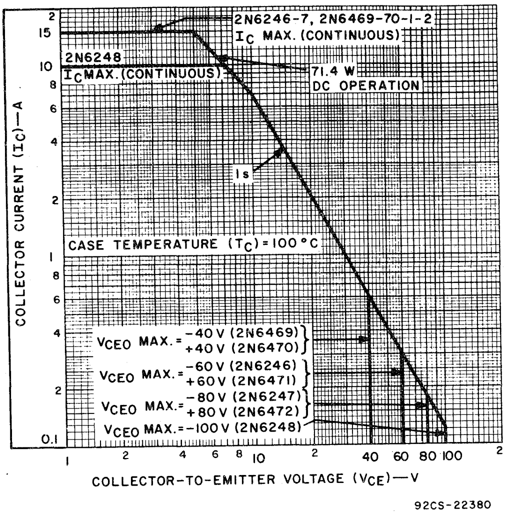


Fig. 17 - Maximum operating areas for all types.◆

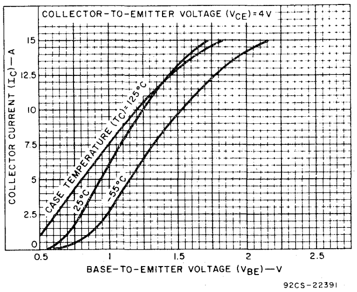


Fig. 18 - Typical transfer characteristics for 2N6470, 2N6471, and 2N6472.

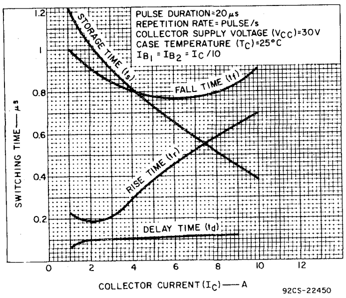


Fig. 19 - Typical saturated switching characteristics for 2N6470, 2N6471, and 2N6472.

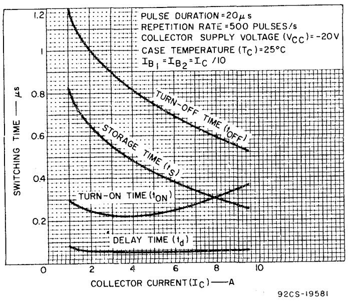


Fig. 20 - Typical saturated switching characteristics for 2N6246, 2N6247, 2N6248, and 2N6469.

◆For p-n-p devices, voltage and current values are negative.

2N6249-2N6251

450-V, 30-A, 175-W Silicon N-P-N Switching Transistors

For Switching Applications in Industrial and Commercial Equipment

RCA-2N6269, 2N6250 and 2N6251 are multiple epitaxial silicon n-p-n power transistors utilizing a multiple-emitter-site structure. Multiple-epitaxial construction maximizes the volt-ampere characteristic of the device and provides fast switching speeds. Multiple-emitter-site design assures uniform current flow throughout the structure, which produces a high $I_{S/b}$ and a large safe-operation area.

These devices use the popular JEDEC TO-3 package; they differ mainly in voltage ratings, leakage-current limits, and V_{CE}(sat) ratings.

The exceptional second-breakdown capabilities and high voltage-breakdown ratings make these transistors especially suitable for off-line inverters, switching regulators, motor controls, and deflection circuit applications.

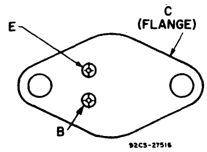
The high gain and high $E_{S/b}$ energy-handling capability of the 2N6249 make it an excellent choice for motor-control applications in which large winding inductances are encountered and high surge currents are required to start the motor.

The high breakdown voltages, low saturation voltages, and fast-switching capability of the 2N6250 and 2N6251 make them especially suitable for inverter circuits operating directly off the rectified 115-V power line or a bridge configuration operating from the rectified 220-V line.

Features:

- **High voltage ratings:**
  V_{CBO}=450 V (2N6251)
  375 V (2N6250)
  300 V (2N6249)
- **High dissipation rating: P_T = 175 W**
- **Low saturation voltages**
- **Maximum safe-area-of-operation curves**

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*		**2N6249**	**2N6250**	**2N6251**	
*COLLECTOR-TO-BASE Voltage	V_{CBO}	300	375	450	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:					
With base open	V_{CEO}(sus)	200	275	350	V
* With reverse bias (V_{BE}) = 0 V (with base-emitter shorted)	V_{CEX}(sus)	225	300	375	V
With external base-to-emitter resistance (R_{BE}) $\leqslant 50\Omega$.	V_{CER}(sus)	225	300	375	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	6	6	6	V
COLLECTOR CURRENT:	I_C				
* Continuous		10	10	10	A
Peak		30	30	30	A
*CONTINUOUS BASE CURRENT	I_B	10	10	10	A
TRANSISTOR DISSIPATION:	P_T				
At case temperatures up to 25°C and V_{CE} up to 30 V		175	175	175	W
At case temperatures up to 25°C and V_{CE} above 30 V		Derate linearly at 1°C/W			
*TEMPERATURE RANGE:					
Storage & Operating (Junction)		—— −65 to +200 ——			°C
*PIN TEMPERATURE (During Soldering):					
At distances $\geqslant$ 1/32 in. (0.8 mm) from case for 10 s max		—— 230 ——			°C

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*2N-Series types in accordance with JEDEC registration data format (JS-6, RDF-1).

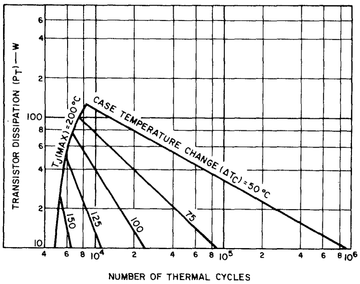

Fig. 1 - Thermal-cycle rating chart for all types.

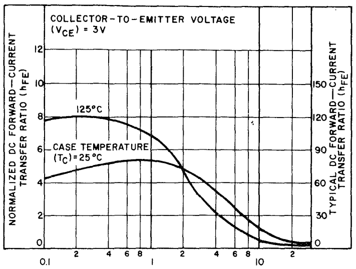

Fig. 2 - Typical normalized dc beta characteristics for all types.

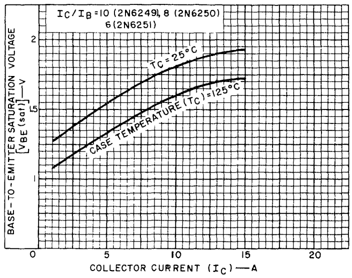

Fig. 3 - Typical base-to-emitter saturation voltage characteristics for all types.

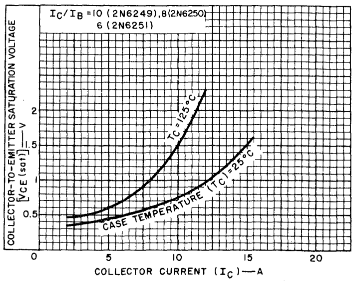

Fig. 4 - Typical collector-to-emitter saturation voltage characteristics for all types.

2N6249-2N6251

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified.*

CHARACTERISTIC	TEST CONDITIONS				LIMITS									UNITS
	DC VOLTAGE (V)		DC CURRENT (A)		2N6249			2N6250			2N6251			
	V_{CE}	V_{BE}	I_C	I_B	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
I_{CEO}	150			0	–	–	5	–	–	–	–	–	–	mA
	225			0	–	–	–	–	–	5	–	–	–	
	300			0	–	–	–	–	–	–	–	–	5	
* I_{CEV}	225	–1.5			–	–	5	–	–	–	–	–	–	
	300	–1.5			–	–	–	–	–	5	–	–	–	
	375	–1.5			–	–	–	–	–	–	–	–	5	
	450	–1.5			–	–	–	–	–	–	–	–	–	
* I_{CEV} T_C = 125°C	225	–1.5			–	–	10	–	–	–	–	–	–	
	300	–1.5			–	–	–	–	–	10	–	–	–	
	375	–1.5			–	–	–	–	–	–	–	–	10	
	450	–1.5			–	–	–	–	–	–	–	–	–	
* I_{EBO}		–6			–	–	1	–	–	1	–	–	1	mA
* $V_{CEO}(sus)$			0.2		200[b]	–	–	275[b]	–	–	350[b]	–	–	V
$V_{CER}(sus)$ R_{BE} = 50 Ω			0.2		225[b]	–	–	300[b]	–	–	375[b]	–	–	V
* V_{EBO} I_E = 1 mA					6	–	–	6	–	–	6	–	–	V
I_E = 5 mA					–	–	–	–	–	–	–	–	–	
* h_{FE}	3		10[a]		10	–	50	–	–	–	–	–	–	
	3		10[a]		–	–	–	8	–	50	–	–	–	
	3		10[a]		–	–	–	–	–	–	6	–	50	
	4		10[a]		–	–	–	–	–	–	–	–	–	
* $V_{BE}(sat)$			10[a]	1	–	–	2.25	–	–	–	–	–	–	V
			10[a]	1.25	–	–	–	–	–	2.25	–	–	–	
			10[a]	1.67	–	–	–	–	–	–	–	–	2.25	
			16[a]	3.2	–	–	–	–	–	–	–	–	–	
* $V_{CE}(sat)$			10[a]	1	–	–	1.5	–	–	–	–	–	–	V
			10[a]	1.25	–	–	–	–	–	1.5	–	–	–	
			10[a]	1.67	–	–	–	–	–	–	–	–	1.5	
			16[a]	3.2	–	–	–	–	–	–	–	–	–	
* $\lvert h_{fe} \rvert$ f = 1 MHz	10		1		2.5	8	–	2.5	8	–	2.5	8	–	
* $I_{S/b}$ t_p = 1s nonrep.	30				5.8	–	–	5.8	–	–	5.8	–	–	A
* $E_{S/b}$ R_B = 50 Ω, L = 50 μH		–4	10[c]		2.5	–	–	2.5	–	–	2.5	–	–	mJ
* t_r V_{CC} = 200 V, I_{B1} = I_{B2}			10	1	–	0.8	2	–	–	–	–	–	–	μs
			10	1.25	–	–	–	–	0.8	2	–	–	–	
			10	1.67	–	–	–	–	–	–	–	0.8	2	
* t_s V_{CC} = 200 V, I_{B1} = I_{B2}			10	1	–	1.8	3.5	–	–	–	–	–	–	
			10	1.25	–	–	–	–	1.8	3.5	–	–	–	
			10	1.67	–	–	–	–	–	–	–	1.8	3.5	
* t_f V_{CC} = 200 V, I_{B1} = I_{B2}			10	1	–	0.5	1	–	–	–	–	–	–	
			10	1.25	–	–	–	–	0.5	1	–	–	–	
			10	1.67	–	–	–	–	–	–	–	0.5	1	
$R_{\theta JC}$	10		5		–	–	1	–	–	1	–	–	1	°C/W

* 2N-Series types in accordance with JEDEC registration data format (JS-6 RDF-1.)

[a] Pulsed; pulse duration ≤ 300 μs, duty factor = 2%.

[b] CAUTION: The sustaining voltages $V_{CEO}(sus)$ and $V_{CER}(sus)$ MUST NOT be measured on a curve tracer.

2N6249-2N6251

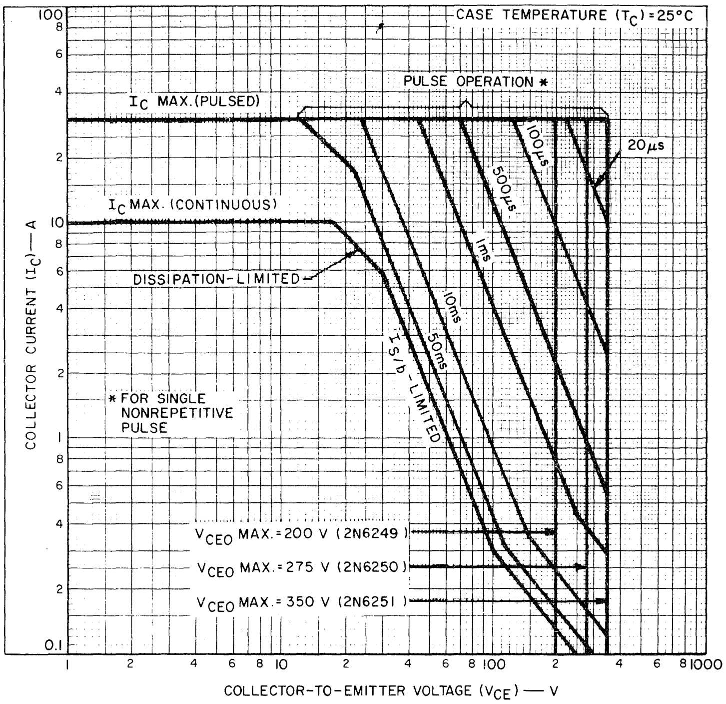

Fig. 5 — Maximum operating areas for 2N6249 — 2N6251.

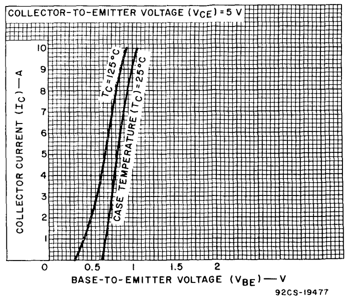

Fig. 6 - Typical transfer characteristics for 2N6249, 2N6250 and 2N6251.

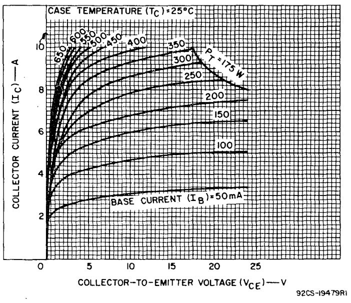

Fig. 7 - Typical output characteristics for all types.

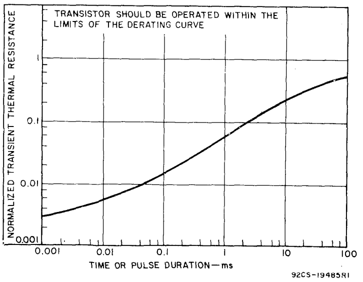

Fig. 8 - Typical thermal response characteristics for all types.

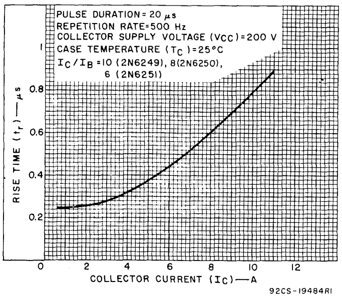

Fig. 9 - Typical rise-time characteristic for 2N6249—2N6251.

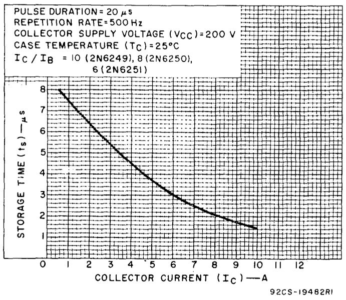

Fig. 10 - Typical storage-time characteristics for 2N6249—2N6251 (with constant forced gain).

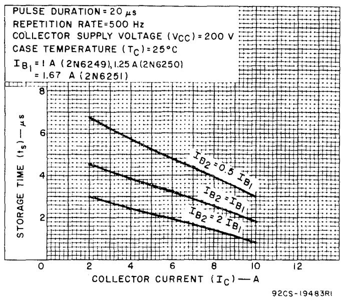

Fig. 11 - Typical storage-time characteristics for 2N6249—2N6251 (with constant base drive).

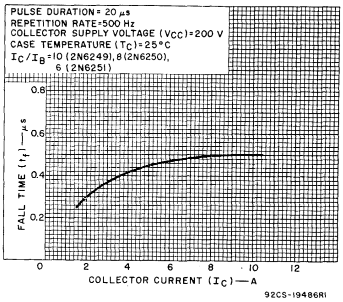

Fig. 12 - Typical fall-time characteristics for 2N6249—2N6251.

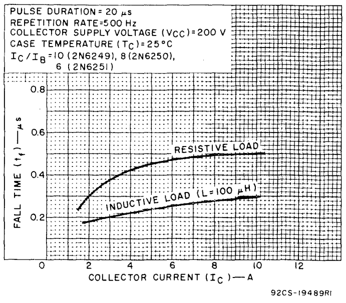

Fig. 13 - Typical inductive and resistive-load fall-time characteristics for 2N6249—2N6251.

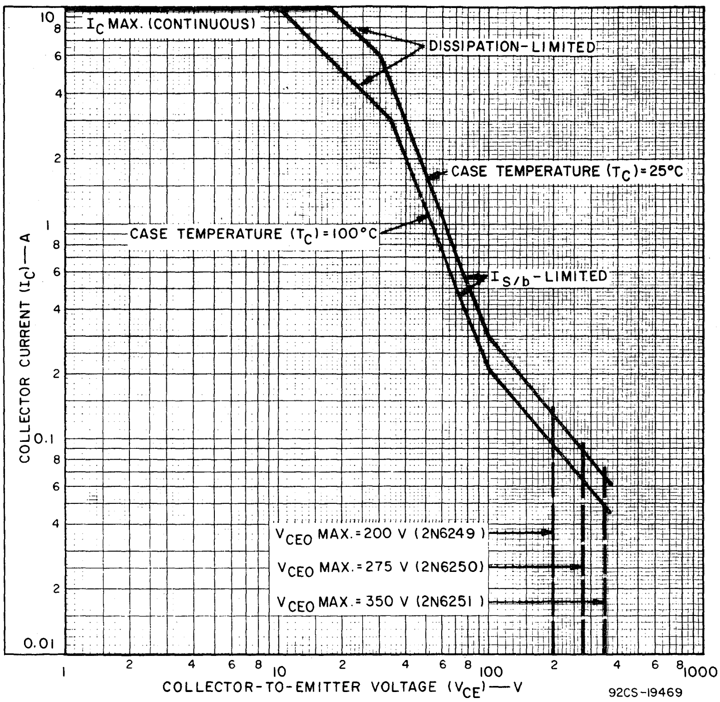

Fig. 14 - Maximum operating areas for 2N6249—2N6251.

2N6282, 2N6283, 2N6284, 2N6285, 2N6286, 2N6287

20-Ampere Complementary N-P-N and P-N-P Monolithic Darlington Power Transistors

60-80-100 Volts, 160 Watts
Gain of 2400 (Typ.) at 10 A (2N6282, 2N6283, 2N6284)
Gain of 3500 (Typ.) at 10 A (2N6285, 2N6286, 2N6287)

The RCA-2N6282, 2N6283, and 2N6284 and the 2N6285, 2N6286, and 2N6287 are complementary n-p-n and p-n-p monolithic silicon Darlington transistors designed for general-purpose amplifier and low-speed switching applications. The high gain of these devices makes it possible for them to be driven directly from integrated circuits. These devices are supplied in the JEDEC TO-3 hermetic steel package.

Features:

- **Operates from IC without predriver**
- **High reverse second-breakdown capability**
- **Monolithic construction**
- **High voltage ratings:**
  $V_{CEO}(sus)$ = 60 V Min. – 2N6282, 2N6285●
  = 80 V Min. – 2N6283, 2N6286●
  = 100 V Min. – 2N6284, 2N6287●

Applications:

- **Power switching**
- **Hammer drivers**
- **Series and shunt regulators**
- **Audio amplifiers**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	2N6282 2N6285●	2N6283 2N6286●	2N6284 2N6287●	
* V_{CBO}	60	80	100	V
* $V_{CEO}(sus)$	60	80	100	V
* V_{EBO}	5	5	5	V
* I_C	20	20	20	A
* I_{CM}	40	40	40	A
* I_B	0.5	0.5	0.5	A
* P_T				
$T_C \leqslant 25^\circ C$	160	160	160	W
$T_C > 25^\circ C$ Derate linearly	0.915			W/°C
* Tstg, TJ	–65 to 200			°C
* T_L				
At distances ⩾1/16 in. (1.58 mm) from case for 10 s max.	235			°C

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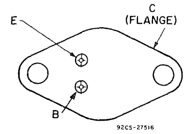
* In accordance with JEDEC registration data.

● For p-n-p devices, voltage and current values are negative.

TERMINAL DESIGNATIONS



JEDEC TO-3

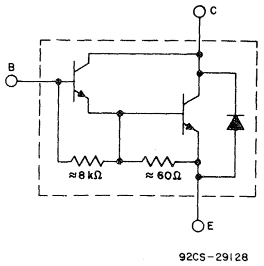


Fig. 1 – Schematic diagram for 2N6282, 2N6283, and 2N6284.

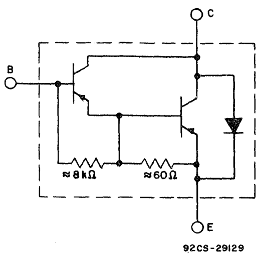


Fig. 2 – Schematic diagram for 2N6285, 2N6286, and 2N6287.

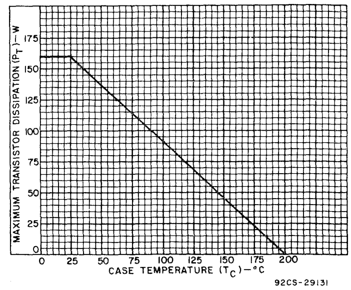


Fig. 3 – Power derating curve for all types.

2N6282, 2N6283, 2N6284, 2N6285, 2N6286, 2N6287

ELECTRICAL CHARACTERISTICS, *at Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS				LIMITS						UNITS
	VOLTAGE V dc		CURRENT A dc		2N6282 2N6285●		2N6283 2N6286●		2N6284 2N6287●		
	V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
* I_{CEO}	30			0	–	1	–	–	–	–	mA
	40			0	–	–	–	1	–	–	
	50			0	–	–	–	–	–	1	
* I_{CEX}	60	−1.5			–	0.5	–	–	–	–	
	80	−1.5			–	–	–	0.5	–	–	
	100	−1.5			–	–	–	–	–	0.5	
T_C = 150°C	60	−1.5			–	5	–	–	–	–	
	80	−1.5			–	–	–	5	–	–	
	100	−1.5			–	–	–	–	–	5	
* I_{EBO}		−5	0		–	2	–	2	–	2	mA
* V_{CEO}(sus)			0.1ᵃ	0	60	–	80	–	100	–	V
* h_{FE}	3		20ᵃ		100	–	100	–	100	–	
	3		10ᵃ		750	18,000	750	18,000	750	18,000	
* V_{CE}(sat)			20ᵃ	0.2	–	3	–	3	–	3	V
			10ᵃ	0.04	–	2	–	2	–	2	
* V_{BE}	3		10ᵃ		–	2.8	–	2.8	–	2.8	V
* V_{BE}(sat)			20ᵃ	0.2	–	4	–	4	–	4	V
* h_{fe} f = 1 kHz	3		10		300	–	300	–	300	–	
* $\lvert h_{fe} \rvert$ f = 1 MHz	3		10		4	–	4	–	4	–	
* C_{ob} V_{CB} = 10 V, I_E 0, f = 0.1 MHz											
2N6282-84					–	400	–	400	–	400	pF
2N6285-87					–	600	–	600	–	600	
$I_{S/b}$ t = 1 s, nonrep.	30				5.3	–	5.3	–	5.3	–	A
$R_{\theta JC}$						1.09	–	1.09	–	1.09	°C/W

[a] Pulsed: Pulse duration = 300 μs, duty factor = 1.8%.

* In accordance with JEDEC registration data.

● For p-n-p devices, voltage and current values are negative.

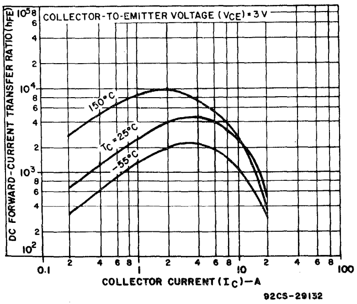


Fig. 4 — Typical dc beta characteristics for 2N6282, 2N6283, and 2N6284.

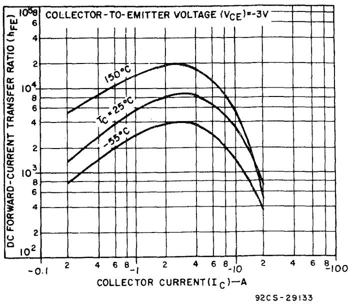
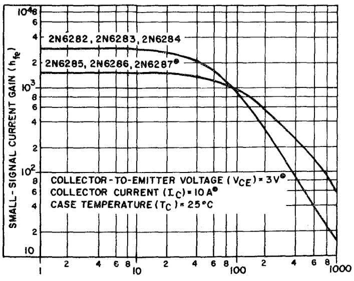


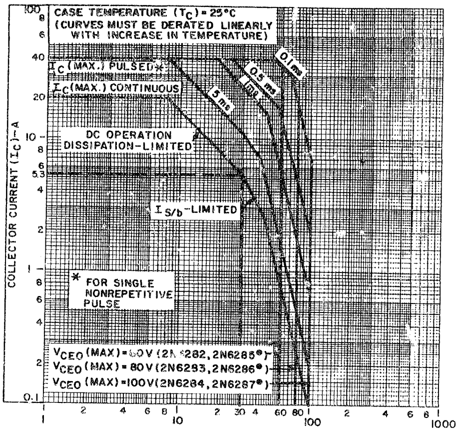
Fig. 5 — Typical dc beta characteristics for 2N6285, 2N6286, and 2N6287.



●FOR p-n-p DEVICES, VOLTAGE AND CURRENT VALUES ARE NEGATIVE

Fig. 6 — Typical small-signal current gain for all types.

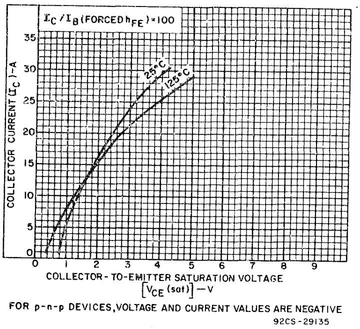
2N6282, 2N6283, 2N6284, 2N6285, 2N6286, 2N6287



92CM-29130

*FOR p-n-p DEVICES, VOLTAGE AND CURRENT VALUES ARE NEGATIVE

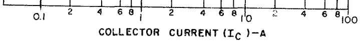
Fig. 7 — Maximum operating areas for all types.



FOR p-n-p DEVICES, VOLTAGE AND CURRENT VALUES ARE NEGATIVE

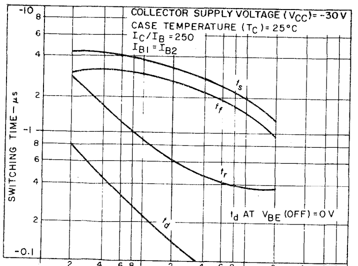
92CS-29135

Fig. 8 — Typical saturation characteristics for all types.



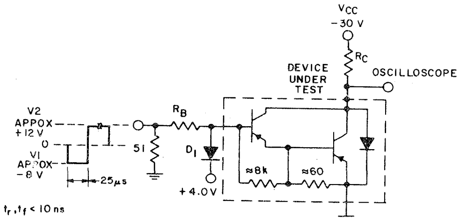
92CS-29136

Fig. 9 — Typical switching times for 2N6282, 2N6283, and 2N6284.



92CS-29137

Fig. 10 — Typical switching times for 2N6285, 2N6286, and 2N6287.



$t_r, t_f < 10$ ns
DUTY CYCLE = 1 %

FOR t_d AND t_r, D_1 IS DISCONNECTED AND V2 = 0

R_B & R_C VARIED TO OBTAIN DESIRED CURRENT LEVELS
D_1 MUST BE FAST RECOVERY TYPE

FOR n-p-n TEST CIRCUIT REVERSE DIODE AND VOLTAGE POLARITIES 92CS-29138

Fig. 11 — Switching times test circuit.

2N6306-2N6308, RCS579

High-Voltage, High-Current Silicon N-P-N Power-Switching Transistors

For Off-Line Power Supplies and Other High-Voltage Switching Applications

The RCA-2N6306, 2N6307, 2N6308, and RCS579 are epitaxial silicon n-p-n power transistors with pi-nu construction. They are hermetically sealed in a steel JEDEC TO-3 package, and differ mainly in voltage ratings, saturation voltage, and beta characteristics. The exceptional second-breakdown and high voltage ratings, together with the high gain, low saturation voltage and fast-switching capability of this series of devices, make them particularly suitable for inverter circuits operating directly off the rectified 120-volt power line or in a bridge configuration operating from the rectified 240-volt line.

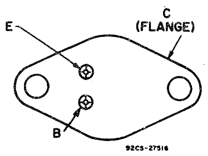
Features:

- Fast Switching Speed
- High Voltage Ratings: V_{CER} = 350 V to 450 V
- High Gain at I_C = 3 A
- Thermal-Cycling Rating Chart

Applications:

- Off-Line Power Supplies
- High-Voltage Inverters
- Switching Regulators
- Motor Controls

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	RCS579	2N6306	2N6307	2N6308	
* V_{CBO}	500	500	600	700	V
$V_{CER(sus)}$ R_{BE} = 50 Ω	400	350	400	450	V
* $V_{CEO(sus)}$	250	250	300	350	V
* V_{EBO}	6	8	8	8	V
* I_C	8	8	8	8	A
* I_{CM}	16	16	16	16	A
* I_B	4	4	4	4	A
* P_T					
T_C up to 25°C	125	125	125	125	W
T_C above 25°C	Derate linearly to 200°C				
* T_{stg}, T_J	−65 to +200				°C
* T_L At distance ⩾ 1/16 in. (1.58 mm) from seating plane for 10 s max.	235				°C

*2N-Series types in accordance with JEDEC registration data format (JS-6 RDF-1)

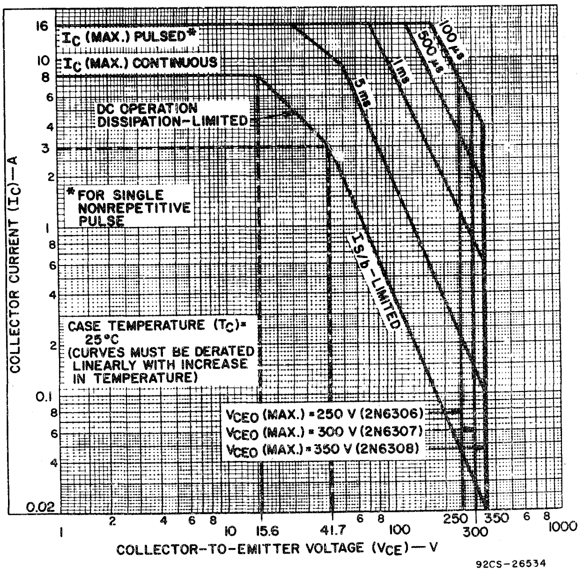


Fig. 1 - Maximum operating areas for 2N6306—2N6308.

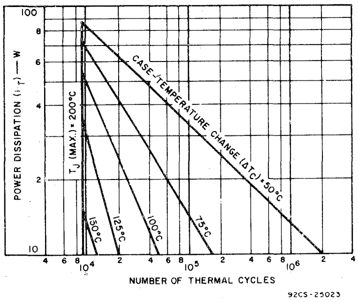


Fig. 2 - Thermal-cycling rating chart for all types.

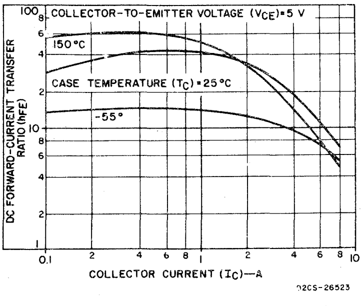


Fig. 3 - Typical dc beta characteristics for all types.

2N6306-2N6308, RCS579

ELECTRICAL CHARACTERISTICS, *T_C - 25°C Unless Otherwise Specified.*

CHARACTERISITC	TEST CONDITIONS				LIMITS								UNITS
	VOLTAGE V dc		CURRENT A dc		2N6306		2N6307		2N6308		RCS579		
	V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
* I_{CEO}	250			0	–	0.5	–	–	–	–	–	0.5	mA
	300			0	–	–	–	0.5	–	–	–	–	
	350			0	–	–	–	–	–	0.5	–	–	
* I_{CEV}	500	−1.5			–	0.5	–	–	–	–	–	0.5	
	600	−1.5			–	–	–	0.5	–	–	–	–	
	700	−1.5			–	–	–	–	–	0.5	–	–	
* T_C = 150°C	450	−1.5			–	2.5	–	–	–	–	–	2.5	
	550	−1.5			–	–	–	2.5	–	–	–	–	
	650	−1.5			–	–	–	–	–	2.5	–	–	
* I_{EBO}		−6	0		–	–	–	–	–	–	–	2	mA
		−8	0		–	1	–	1	–	1	–	–	
* V_{CEO}(sus)			0.1[a]	0	250	–	300	–	350	–	250	–	V
V_{CER}(sus) R_{BR} = 50 Ω			0.1[b]		350	–	400	–	450	–	400	–	V
V_{EBO} I_E = 1 mA			0		–	–	–	–	–	–	6	–	V
* h_{FE}	5		3[a]		15	75	15	75	12	60	12	–	
	5		8[a]		4	–	4	–	3	–	3	–	
* V_{BE}	5		3[a]		–	1.3	–	1.3	–	1.5	–	1.5	V
* V_{BE}(sat)			8[a]	2	–	2.3	–	2.3	–	–	–	–	V
			8[a]	2.67	–	–	–	–	–	2.5	–	2.5	
* V_{CE}(sat)			3[a]	0.6	–	0.8	–	1	–	1.5	–	1.5	V
			8[a]	2	–	5	–	5	–	–	–	–	
			8[a]	2.67	–	–	–	–	–	5	–	5	
* $\|h_{fe}\|$ * f = 1 MHz	10		0.3		5	–	5	–	5	–	5	–	
* $E_{S/b}$ L = 40 mH R_{BB} = 3kΩ		−1.5	3		180	–	180	–	180	–	180	--	mJ
$I_{S/s}$ t_p = 1 s, nonrep.	40				3.15	–	3.15	–	3.15	–	3.15	–	A
* C_{obo} V_{CB} = 10 V, f = 0.1 MHz					–	250	–	250	–	250	–	250	pF
* t_r V_{CC} = 125 V			3	0.6	–	0.6	–	0.6	–	0.6	–	0.6	μs
* t_s V_{CC} = 125 V t_p = 25 μs			3	+0.6	–	1.6	–	1.6	–	1.6	–	+0.6	
				−1.5								−1.5	
t_p = 5 μs				+0.6	–	0.8	–	0.8	–	0.8	–	–	
			3	−1.5									
* t_f				+0.6	–	0.4	–	0.4	–	0.4	–	+0.6	
V_{CC} = 125 V			3	−1.5								−1.5	
$R_{\theta JC}$					–	1.4	–	1.4	–	1.4	–	1.4	°C/W

. * 2N-Series types in accordance with JEDEC registration data fomat (JS-6, RDF-1).

[a] Pulsed; pulse duration = 300 μs, duty factor ⩽ 2%.

[b] CAUTION: The sustaining voltage V_{CEO}(sus) and V_{CER}(sus) MUST NOT be measured on a curve tracer. V_{CEO}(sus) should be measured by the pulse method (Note "a").

2N6306-2N6308, RCS579

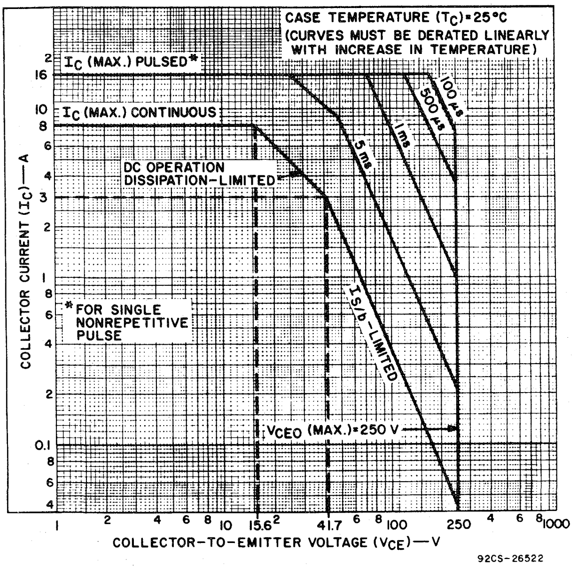


Fig. 4 - Maximum operating areas for RCS579.

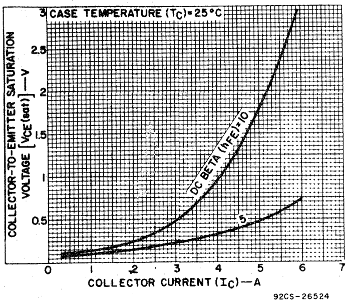


Fig. 5 - Typical collector-to-emitter saturation-voltage characteristics for all types.

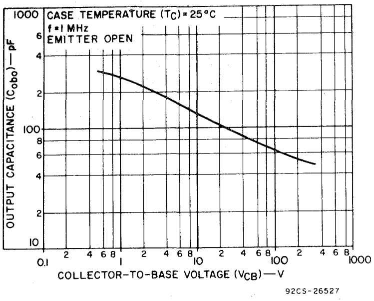


Fig. 6 - Typical output capacitance for all types.

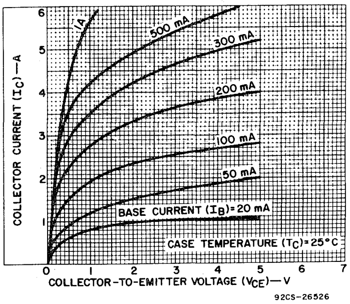


Fig. 7 - Typical output characteristics for all types.

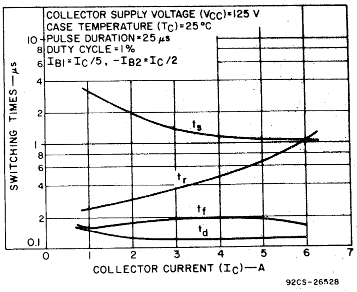


Fig. 8 - Typical saturated-switching-time characteristics for all types.

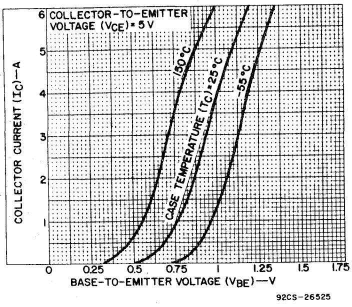


Fig. 9 - Typical transfer characteristics for all types.

2N6338, 2N6339, 2N6340, 2N6341

High-Voltage, High-Current Silicon N-P-N Power-Switching Transistors

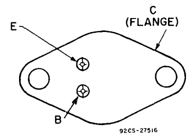
For High-Voltage Switching and Power Amplifier Applications

Features:

- Fast switching speed at I_C = 10 A
- High voltage ratings
- Low saturation voltages
- High gain at I_C = 25 A

The RCA-2N6338, 2N6339, 2N6340, and 2N6341 are epitaxial silicon n-p-n transistors with high current and power-handling capability and fast switching speeds. These devices are especially suitable for switching-control amplifiers, power gates, switching regulators, power-switching circuits, converters, inverters, and control circuits. They are supplied in hermetic, steel JEDEC TO-3 packages.

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	2N6338	2N6339	2N6340	2N6341	
* V_{CBO}	120	140	160	180	V
* V_{CEO}(sus)	100	120	140	150	V
* V_{EBO}	6	6	6	6	V
* I_C	25	25	25	25	A
* I_{CM}	50	50	50	50	A
* I_B	10	10	10	10	A
* P_T					
T_C up to 25°C	200	200	200	200	W
T_C above 25°C . . . . . Derate linearly	1.143				W/°C
* T_{stg}, T_J	−65 to +200				°C
* T_L					
At distance ⩾ 1/8 in. (3.17 mm) from seating plane for 10 s max.	235				°C

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* In accordance with JEDEC registration data format (JS-6 RDF-1).

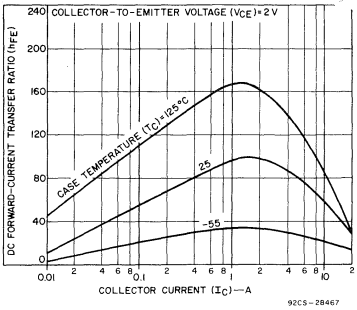


Fig.2 – Typical dc beta characteristics for all types.

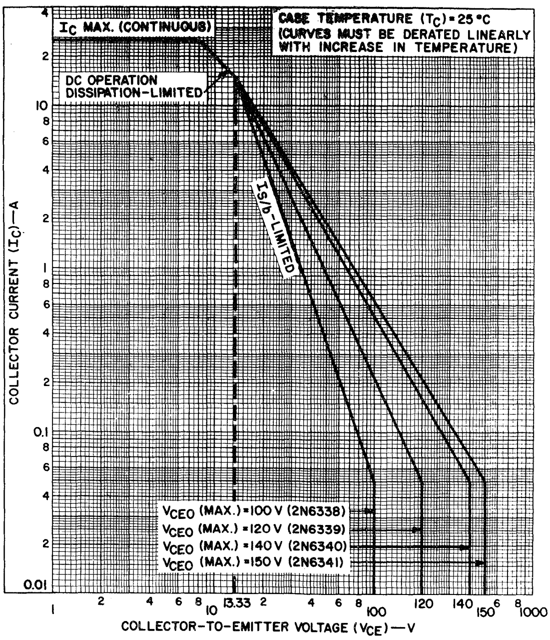


Fig.1 – Maximum operating areas for all types.

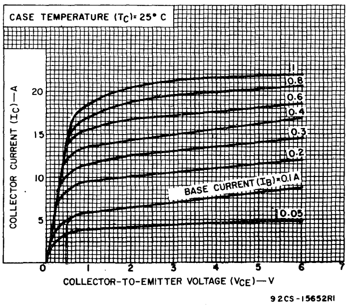


Fig.3 – Typical output characteristics for all types.

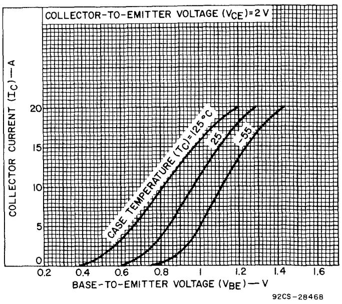


Fig.4 – Typical transfer characteristics for all types.

2N6338, 2N6339, 2N6340, 2N6341

ELECTRICAL CHARACTERISTICS, *$T_C = 25^oC$ Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS			LIMITS								
	VOLTAGE V dc	CURRENT A dc		2N6338		2N6339		2N6340		2N6341		
	V_{CE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	UNITS
* I_{CBO} $I_E = 0$	120●			–	10	–	–	–	–	–	–	μA
	140●			–	–	–	10	–	–	–	–	
	160●			–	–	–	–	–	10	–	–	
	180●			–	–	–	–	–	–	–	10	
* I_{CEX} $V_{BE} = -1.5$ V	100			–	10	–	–	–	–	–	–	μA
	120			–	–	–	10	–	–	–	–	
	140			–	–	–	–	–	10	–	–	
	150			–	–	–	–	–	–	–	10	
* $T_C = 150^oC$	100			–	1	–	–	–	–	–	–	mA
	120			–	–	–	1	–	–	–	–	
	140			–	–	–	–	–	1	–	–	
	150			–	–	–	–	–	–	–	1	
* I_{EBO} $V_{BE} = -6$ V		0		–	100	–	100	–	100	–	100	μA
* $V_{CEO}(sus)$		0.05[a]	0	100[b]	–	120[b]	–	140[b]	–	150[b]	–	V
* h_{FE}	2	0.5[a]		50	–	50	–	50	–	50	–	
	2	10[a]		30	120	30	120	30	120	30	120	
	2	25[a]		12	–	12	–	12	–	12	–	
V_{BE}	2	10[a]		–	1.8	–	1.8	–	1.8	–	1.8	V
* $V_{BE}(sat)$		10[a]	1	–	1.8	–	1.8	–	1.8	–	1.8	V
		25[a]	2.5	–	2.5	–	2.5	–	2.5	–	2.5	
* $V_{CE}(sat)$		10[a]	1	–	1	–	1	–	1	–	1	V
		25[a]	2.5	–	1.8	–	1.8	–	1.8	–	1.8	
* h_{fe} f = 10 MHz	10	1		4	–	4	–	4	–	4	–	
* C_{obo} $I_E = 0$ f = 0.1 MHz	10●			–	300	–	300	–	300	–	300	pF
* t_r $V_{CC} = 80$ V $V_{BE} = -6$ V		10	1[c]	–	0.3	–	0.3	–	0.3	–	0.3	μs
* t_s $V_{CC} = 80$ V $V_{BE} = -6$ V		10	1[c]	–	1	–	1	–	1	–	1	
* t_f $V_{CC} = 80$ V $V_{BE} = -6$ V		10	1[c]	–	0.25	–	0.25	–	0.25	–	0.25	
$R_{\theta JC}$		10	5	–	0.875	–	0.875	–	0.875	–	0.875	$^oC/W$

* In accordance with JEDEC registration data format (JS-6, RDF-1).

● V_{CB}

[a] Pulsed; pulse duration = 300 μs, duty factor $\leqslant$2%.

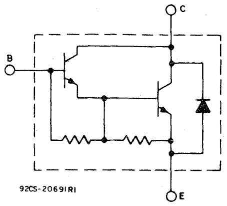
[b] CAUTION: The sustaining voltage $V_{CEO}(sus)$ MUST NOT be measured on a curve tracer. $V_{CEO}(sus)$ should be measured by the pulse method (Note 'a').

[c] $I_{B1} = I_{B2}$.

2N6383-2N6385, 2N6055, 2N6056, RCA1000, RCA1001
8- and 10-Ampere N-P-N Darlington Power Transistors

For Use as Output Devices in Switching and Amplifier Applications
40-60-80 Volts, 90-100 Watts

The RCA devices are monolithic n-p-n silicon Darlington transistors designed for low- and medium-frequency power applications. The double epitaxial construction of these devices provides good forward and reverse second-breakdown capability; their high gain makes it possible for them to be driven directly from integrated circuits.



Schematic diagram for all types.

Features:

- Operation from IC without predriver
- Low leakage at high temperature
- High reverse-second-breakdown capability

Applications:

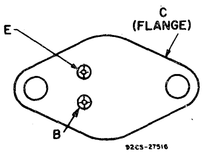
- Power switching
- Audio amplifiers
- Series and shunt regulators
- Hammer drivers

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	2N6385	2N6384	2N6383	2N6055	2N6056	RCA1000	RCA1001	
*V_{CBO}	80	60	40	60	80	60	80	V
V_{CER}(sus)								
R_{BE} = 100 Ω	80	60	40	60	80	–	–	V
*V_{CEO}(sus)	80	60	40	60	80	60	80	V
V_{CEV}(sus)								
V_{BE} = –1.5 V	–	–	–	60	80	–	–	V
*V_{CEX}								
V_{BE} = –1.5 V, R_{BB} = 100 Ω	80	60	40	–	–	–	–	V
*V_{EBO}	5	5	5	5	5	5	5	V
*I_C	10	10	10	8	8	8	8	A
I_{CM}	15	15	15	16	16	15	15	A
*I_B	0.25	0.25	0.25	0.12	0.12	0.1	0.1	mA
*P_T								
$T_C \leqslant 25°C$	100	100	100	100	100	90	90	W
$T_C > 25°C$	Derate linearly to 200°C							
*T_{stg}, T_J	–65 to +200							°C
*T_L								
At distance ⩾ 1/32 in. (0.8 mm) from seating plane for 10 s max.	235							°C

*2N-Series types in accordance with JEDEC registration data format JS-6 RDF-2.

TERMINAL DESIGNATIONS



JEDEC TO-3

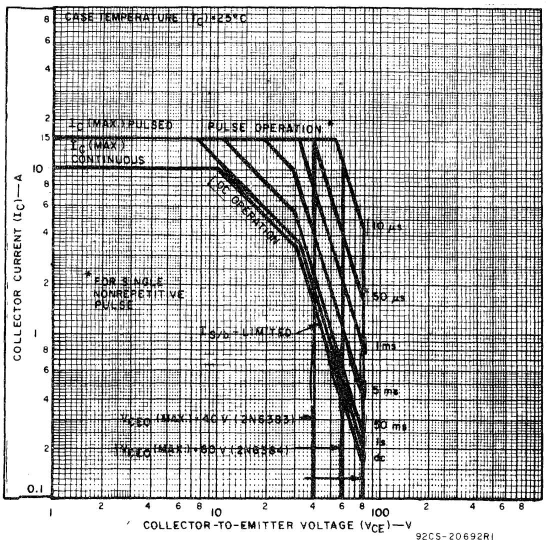


Fig. 1 – Maximum operating area for 2N6383–2N6385.

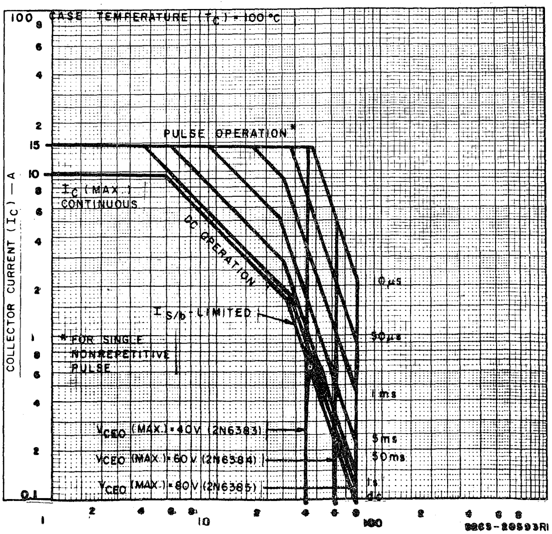


Fig. 2 – Maximum operating area for 2N6383 – 2N6385 at T_C = 100°C.

2N6383-2N6385, 2N6055, 2N6056, RCA10000, RCA1001

ELECTRICAL CHARACTERISTICS, *At Case Temperature, T_C = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS					LIMITS						UNITS
	VOLTAGE V dc			CURRENT A dc		2N6385		2N6384		2N6383		
	V_{CE}	V_{EB}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
* I_{CEO}	80				0	–	1	–	–	–	–	
	60				0	–	–	–	1	–	–	
	40				0	–	–	–	–	–	1	
* I_{CEV}	80		−1.5			–	0.3	–	–	–	–	
	60		−1.5			–	–	–	0.3	–	–	
	40		−1.5			–	–	–	–	–	0.3	mA
T_C = 150°C	80		−1.5			–	3	–	–	–	–	
	60		−1.5			–	–	–	3	–	–	
	40		−1.5			–	–	–	–	–	3	
* I_{EBO}		5		0		–	5	–	5	–	5	mA
* $V_{CEO}(sus)$				0.2^a	0	80	–	60	–	40	–	
* $V_{CER}(sus)$ R_{BE} = 100 Ω				0.2^a		80	–	60	–	40	–	V
$V_{CEV}(sus)$			−1.5	0.2^a		80	–	60	–	40	–	
* h_{FE}	3			5^a		1000	20,000	1000	20,000	1000	20,000	
	3			10^a		100	–	100	–	100	–	
* V_{BE}	3			5^a		–	2.8	–	2.8	–	2.8	V
	3			10^a		–	4.5	–	4.5	–	4.5	
* $V_{CE}(sat)$				5^a	0.01^a	–	2	–	2	–	2	V
				10^a	0.1^a	–	3	–	3	–	3	
V_F				−10		–	4	–	4	–	4	
* h_{fe} f = 1 kHz	5			1		1000	–	1000	–	1000	–	
* $\|h_{fe}\|$ f = 1 MHz	5			1		20	–	20	–	20	–	
* C_{obo} f = 1 MHz	V_{CB} = 10				I_E=0	–	200	–	200	–	200	pF
$E_{S/b}$[b] L = 12 mH, R_{BE} = 100 Ω			−1.5	4.5		120	–	120	–	120	–	mJ
$I_{S/b}$	75					0.22	–	–	–	–	–	
t = 1 s,	55					–	–	0.55	–	–	–	A
non rep.	30					3.33	–	3.33	–	3.33	–	
$R_{\theta JC}$						–	1.75	–	1.75	–	1.75	°C/W

[a] Pulsed: Pulse duration = 300 μs, duty factor = 1.8%.

[b] $E_{S/b}$ is defined as the energy at which second breakdown occurs under specified reverse bias conditions. $E_{S/b}$ = $1/2LI^2$ where L is a series load or leakage inductance, and I is the peak collector current.

* 2N-Series types in accordance with JEDEC registration data format JS-6 RDF-2.

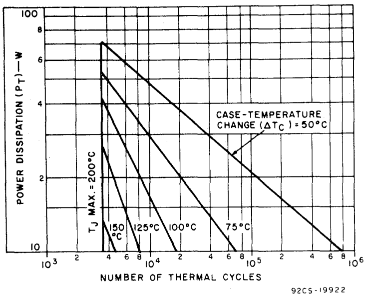


Fig. 3 - Thermal-cycling rating chart for 2N6055–2N6056, 2N6383–2N6385.

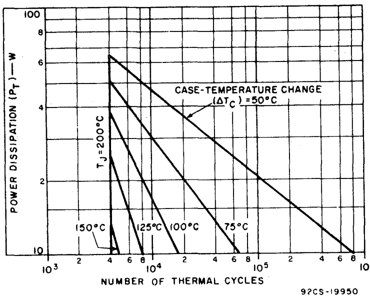


Fig. 4 - Thermal-cycling rating chart for RCA1000, RCA1001.

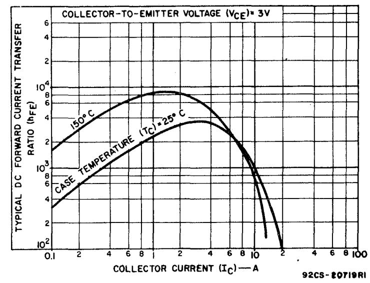


Fig. 5 - Typical dc beta characteristics for all types.

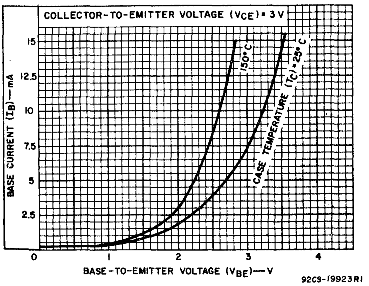


Fig. 6 - Typical input characteristics for 2N6383–2N6385, 2N6055, 2N6056.

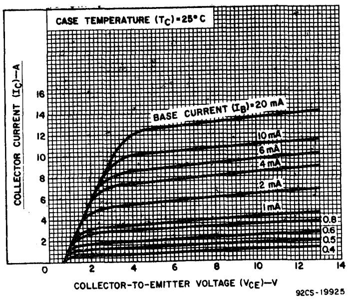


Fig. 7 - Typical output characteristics for 2N6383–2N6385, 2N6055, 2N6056.

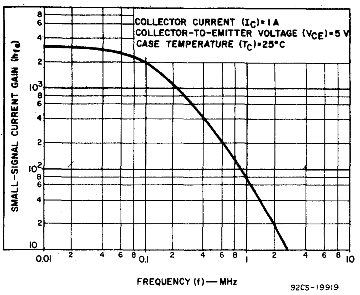


Fig. 8 - Typical small-signal gain for all types.

2N6383-2N6385, 2N6055, 2N6056, RCA1000, RCA1001

ELECTRICAL CHARACTERISTICS, *At Case Temperature, T_C = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS						LIMITS								UNITS
	DC VOLTAGE V			DC CURRENT A			2N6055		2N6056		RCA1000		RCA1001		
	V_{CE}	V_{EB}	V_{BE}	I_C	I_E	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
* I_{CEO}	30					0	–	0.5	–	–	–	0.5	–	–	mA
	40					0	–	–	–	0.5	–	–	–	0.5	
I_{CER}	60						–	–	–	–	–	1	–	–	
R_{BE} = 1 kΩ	80						–	–	–	–	–	–	–	1	
I_{CER}	60						–	–	–	–	–	5	–	–	mA
R_{BE} = 1 kΩ T_C = 150°C	80						–	–	–	–	–	–	–	5	
I_{CEX}	60		–1.5				–	0.5	–	–	–	–	–	–	mA
	80		–1.5				–	–	–	0.5	–	–	–	–	
I_{CEX}	60		–1.5				–	5	–	–	–	–	–	–	
T_C = 150°C	80		–1.5				–	–	–	5	–	–	–	–	
* I_{EBO}		5		0			–	2	–	2	–	2	–	2	mA
* h_{FE}	3			8^a			100	–	100	–	–	–	–	–	
	3			4^a			750	18,000	750	18,000	750	–	750	–	
	3			3^a			–	–	–	–	1000	–	1000	–	
$V_{(BR)CEO}$				0.1^a	0		–	–	–	–	60	–	80	–	V
$V_{CEO}(sus)$				0.1^a			60^a	–	80^a	–	–	–	–	–	V
$V_{CER}(sus)$ R_{BE} = 100 Ω				0.1^a			60^a	–	80^a	–	–	–	–	–	
$V_{CEX}(sus)$			–1.5	0.1^a			60^a	–	80^a	–	–	–	–	–	
* $V_{CE}(sat)$				3^a		0.012	–	–	–	–	–	2	–	2	V
				4^a		0.016	–	2	–	2	–	–	–	–	
				8^a		0.04	–	–	–	–	–	4	–	4	
				8^a		0.08	–	3	–	3	–	–	–	–	
* V_{BE}	3			3^a			–	–	–	–	–	2.5	–	2.5	V
	3			4^a			–	2.8	–	2.8	–	–	–	–	
$V_{BE}(sat)$				8^a		0.08	–	4	–	4	–	–	–	–	
* $\lvert h_{fe}\rvert$ f = 1 MHz	3			3			4	–	4	–	–	–	–	–	
* C_{obo} f = 0.1 MHz, V_{CB} = 10 V					0		–	200	–	200	–	–	–	–	pF
* h_{fe} f = 1 kHz	3			3			300	–	300	–	–	–	–	–	
$E_{S/b}{}^b$ L = 12 mH, R_{BE} = 100 Ω			–1.5	5			150	–	150	–	–	–	–	–	mJ
$I_{S/b}$ t = 1 s, non rep.	33.3						3	–	3	–	–	–	–	–	A
	40						–	–	2	–	–	–	–	–	
$R_{\theta JC}$							–	1.75	–	1.75	–	1.94	–	1.94	°C/W

* In accordance with JEDEC registration data format JS-6 RDF-2.

[a] Pulsed: Pulse duration = 300 μs, duty factor = 2%

[b] $E_{/Sb}$ is defined as the energy at which second breakdown occurs under specified reverse bias conditions. $E_{S/b} = 1/2LI^2$, where L is a series load or leakage inductance and I is the peak collector current.

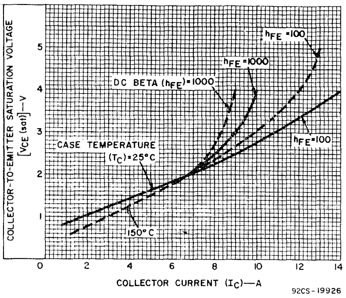


Fig. 9 - Typical saturation characteristics for 2N6055, 2N6056, RCA1000, RCA1001.

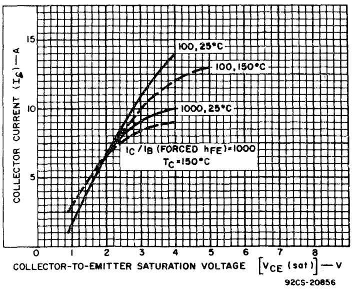


Fig. 10 - Typical saturation characteristics for 2N6383—2N6385.

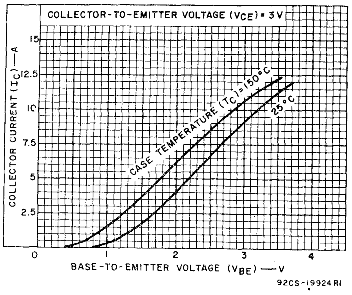


Fig. 11 - Typical transfer characteristics for 2N6383—2N6385, 2N6055, 2N6056.

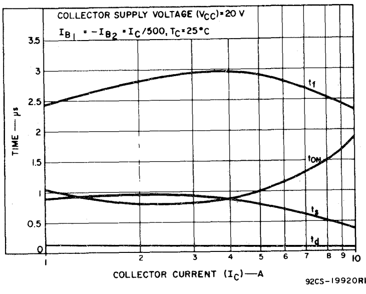


Fig. 12 - Typical saturated switching-time characteristics for 2N6383—2N6385, 2N6055, 2N6056.

2N6383-2N6385, 2N6055, 2N6056, RCA1000, RCA1001

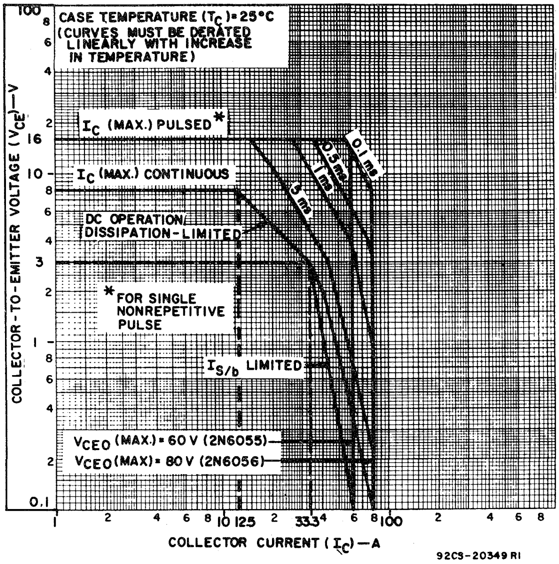


Fig. 13 — Maximum operating areas for 2N6055 and 2N6056.

2N6386-2N6388, RCA120-RCA122
8- and 10-Ampere N-P-N Darlington Power Transistors

60-80-100 Volts, 65 Watts

These RCA devices are monolithic n-p-n silicon Darlington transistors designed for low- and medium-frequency power applications. The double epitaxial construction of these transistors provides good forward and reverse second-breakdown capability; their high gain makes it possible for them to be driven directly from integrated circuits.

These devices are supplied in the JEDEC TO-220AB straight-lead version of the VERSAWATT package. Optional lead configurations are available upon request. For information, contact your nearest RCA Sales Office.

The 2N6386, 2N6387, and 2N6388 are complementary to the RCA8203, RCA8203A and RCA8203B Technical data for RCA8203, RCA8203A and RCA8203B are given in RCA Bulletin File No. 835.

The RCA120 and RCA121 are n-p-n complements of the RCA125 and RCA 126 described in RCA data bulletin File 841.

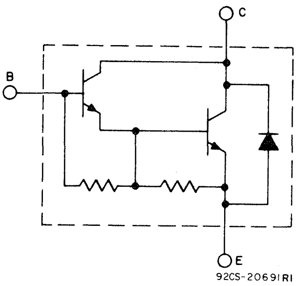


Fig. 1 - Schematic diagram for all types.

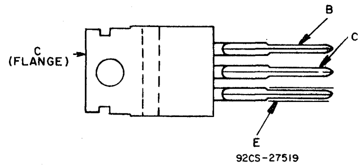
Features:

- **Operates from IC without predriver**
- **Low leakage at high temperature**
- **High reverse second-breakdown capability**

Applications:

- **Power switching**
- **Hammer drives**
- **Series and shunt regulators**
- **Audio amplifiers**

TERMINAL DESIGNATIONS



BOTTOM VIEW
JEDEC TO-220AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	2N6386	2N6387	2N6388	RCA120	RCA121	RCA122	
* V_{CBO}	40	60	80	60	80	100	V
V_{CER}(sus)							
R_{BE} = 100 Ω	40	60	80	60	80	100	V
V_{CEO}(sus)	40	60	80	60	80	100	V
* V_{CEV}(sus)							
V_{BE} = −1.5 V	40	60	80	60	80	100	V
* V_{EBO}	5	5	5	5	5	5	V
* I_C	8	10	10	8	8	8	A
I_{CM}	15	15	15	10	10	10	A
* I_B	0.25	0.25	0.25	0.25	0.25	0.25	A
* P_T							
$T_C \leqslant 25^oC$	65	65	65	65	65	65	W
$T_C > 25^oC$	Derate linearly to 150°C						
* T_{stg}, T_J	−65 to +150						^oC
* T_L At distances ⩾ 1/8 in. (3.17 mm) from case for 10 s max.	235						^oC

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* 2N- Series types in accordance with JEDEC registration data format JS-6 RDF-2.

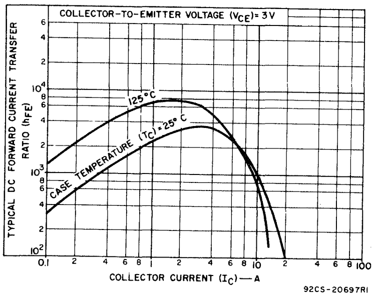


Fig. 2 - Typical dc beta characteristics for 2N6386–2N6388.

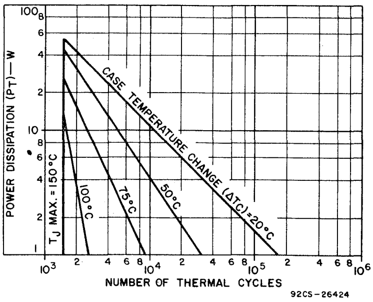


Fig. 3 - Thermal-cycling rating chart for 2N6386–2N6388.

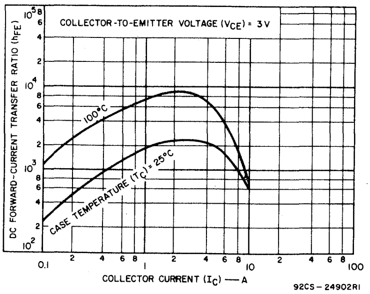


Fig. 4 - Typical dc beta characteristics for RCA120–RCA122.

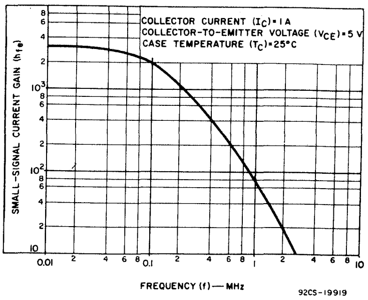


Fig. 5 - Typical small-signal gain for all types.

2N6386-2N6388, RCA120-RCA122

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC SYMBOL	TEST CONDITIONS				LIMITS						UNITS
	VOLTAGE V dc		CURRENT A dc		2N6386		2N6387		2N6388		
	V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
* I_{CEO}	80			0	–	–	–	–	–	1	mA
	60			0	–	–	–	1	–	–	
	40			0	–	1	–	–	–	–	
* I_{CEV}	80	–1.5			–	–	–	–	–	0.3	
	60	–1.5			–	–	–	0.3	–	–	
	40	–1.5			–	0.3	–	–	–	–	
T_C = 125°C	80	–1.5			–	–	–	–	–	3	
	60	–1.5			–	–	–	3	–	–	
	40	–1.5			–	3	–	–	–	–	
* I_{EBO}		5	0		–	5	–	5	–	5	mA
* V_{CEO}(sus)			0.2^a	0	40	–	60	–	80	–	V
V_{CER}(sus) R_{BE} = 100 Ω			0.2^a		40	–	60	–	80	–	
V_{CEV}(sus)		–1.5	0.2^a		40	–	60	–	80	–	
* h_{FE}	3		3^a		1000	20,000	–	–	–	–	
	3		5^a		–	–	1000	20,000	1000	20,000	
	3		8^a		100	–	–	–	–	–	
	3		10^a		–	–	100	–	100	–	
* V_{BE}	3		3^a		–	2.8	–	–	–	–	V
	3		5^a		–	–	–	2.8	–	2.8	
	3		8^a		–	4.5	–	–	–	–	
	3		10^a		–	–	–	4.5	–	4.5	
* V_{CE}(sat)			3^a	0.006^a	–	2	–	–	–	–	V
			5^a	0.01^a	–	–	–	2	–	2	
			8^a	0.08^a	–	3	–	–	–	–	
			10^a	0.1^a	–	–	–	3	–	3	
V_F			–8^a		–	4	–	–	–	–	V
			–10^a		–	–	–	4	–	4	
* h_{fe} f = 1 kHz	5		1		1000	–	1000	–	1000	–	
* $\|h_{fe}\|$ f = 1 MHz	5		1		20	–	20	–	20	–	
* C_{ob} V_{CB} = 10 V, f = 1 MHz					–	200	–	200	–	200	pF
$E_{S/b}$ L = 12 mH R_{BE} = 100 Ω		–1.5	4.5		120	–	120	–	120	–	mJ
$I_{S/b}$ t = 1 s, nonrep.	25				2.6	–	2.6	–	2.6	–	A
$R_{\theta JC}$					–	1.92	–	1.92	–	1.92	°C/W

[a] Pulsed: Pulse duration = 300 μs, duty factor = 1.8%.

* In accordance with JEDEC registration data format JS-6 RDF-2.

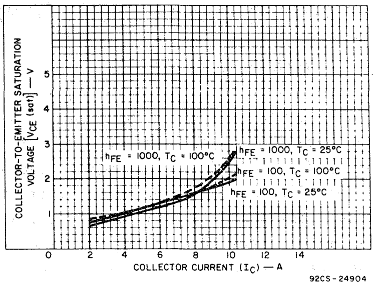


Fig. 6 - Typical saturation characteristics for RCA120–RCA122.

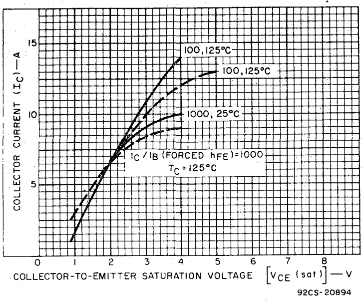


Fig. 7 - Typical saturation characteristics for 2N6386–2N6388.

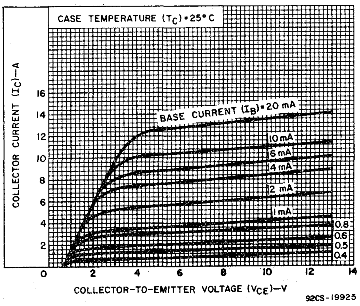


Fig. 8 - Typical output characteristics for 2N6386-2N6388.

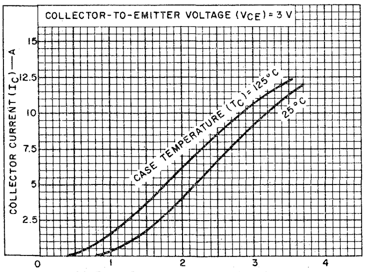


Fig. 9 - Typical transfer characteristics for 2N6386–2N6388.

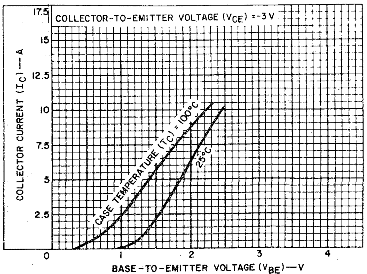


Fig. 10 - Typical transfer characteristics for RCA120–RCA122.

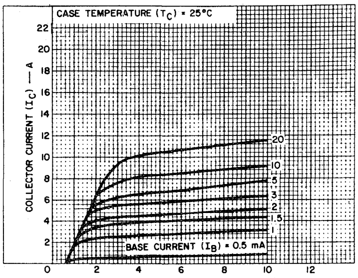


Fig. 11 - Typical output characteristics for RCA120-RCA122.

2N6386-2N6388, RCA120-RCA122

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C*

CHARACTERISTIC	TEST CONDITIONS				LIMITS						UNITS
	VOLTAGE V dc		CURRENT A dc		RCA120		RCA121		RCA122		
	V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
I_{CBO} I_E=0	60 80 100				– – –	0.2 – –	– – –	– 0.2 –	– – –	– – 0.2	mA
I_{CEO}	30 40 50			0 0 0	– – –	0.5 – –	– – –	– 0.5 –	– – –	– – 0.5	
I_{EBO}		–5	0		–	3	–	3	–	3	mA
V_{CEO}(sus)			0.2^a	0	60	–	80	–	100	–	V
h_{FE}	3 3		3^a 0.5^a		1000 500	– –	1000 500	– –	1000 500	– –	
V_{BE}	3		3^a		–	2.5	–	2.5	–	2.5	V
V_{CE}(sat)			3^a 5^a	0.012 0.02	– –	2 3	– –	2 3	– –	2 3	V
h_{fe} f=1 kHz	5		1		1000	–	1000	–	1000	–	
$\|h_{fe}\|$ f=1 MHz	5		1		20	–	20	–	20	–	
C_{obo} V_{CB}=10 V, f=1 MHz					–	200	–	200	–	200	pF
$E_{S/b}$ L=12 mH, R_{BE}=100 Ω		–1.5	4.5		120	–	120	–	120	–	mJ
$I_{S/b}$ t=0.5 s, nonrep.	25				2.6	–	2.6	–	2.6	–	A
$R_{\theta JC}$					–	1.92	–	1.92	–	1.92	°C/W

[a] Pulsed, pulse duration = 300 μs, duty factor ⩽ 2%.

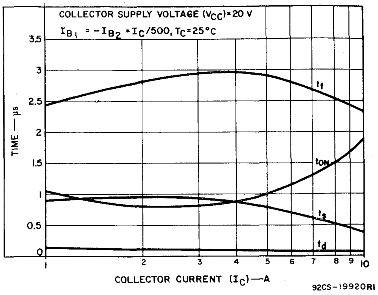


Fig. 12 - Typical saturated switching-time characteristics for 2N6386–2N6388.

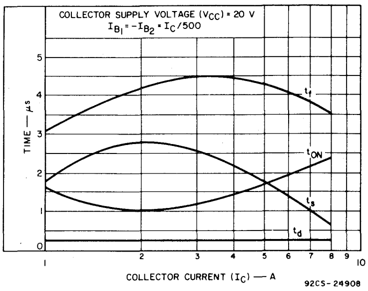


Fig. 13 - Typical saturated switching characteristics for RCA120–RCA122.

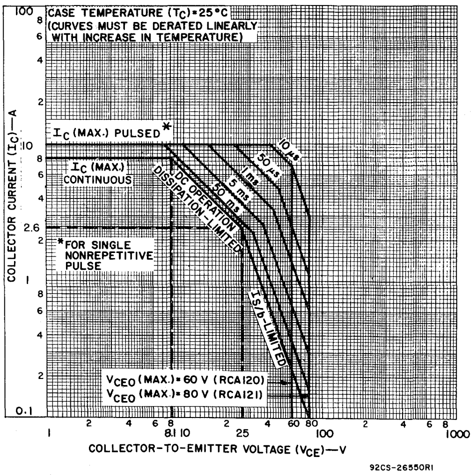


Fig. 14 - Minimum operating areas for RCA120 and RCA121 at T_C = 25°C.

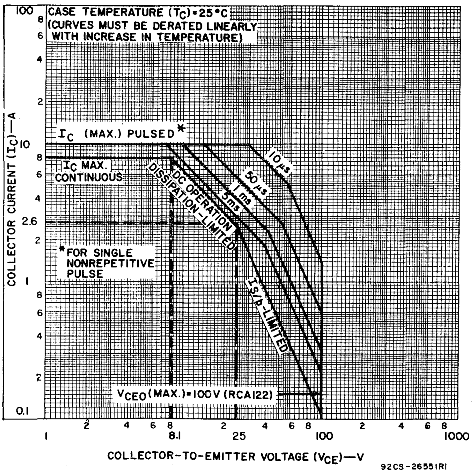


Fig. 15 - Maximum operating areas for RCA122 at T_C = 25°C.

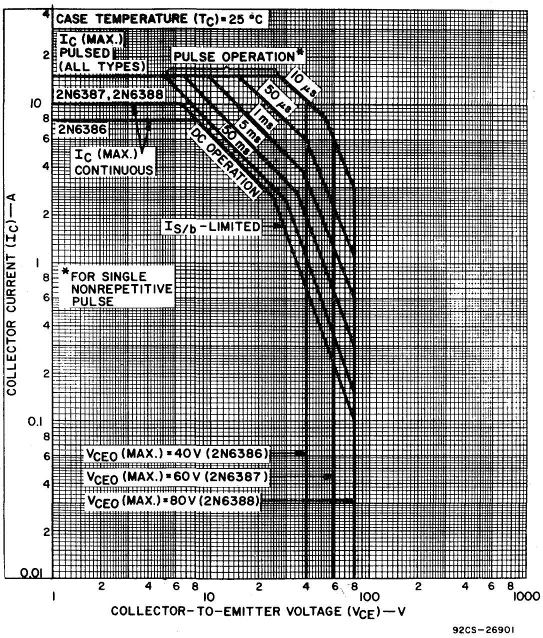


Fig. 16 - Maximum operating areas for 2N6386–2N6388.

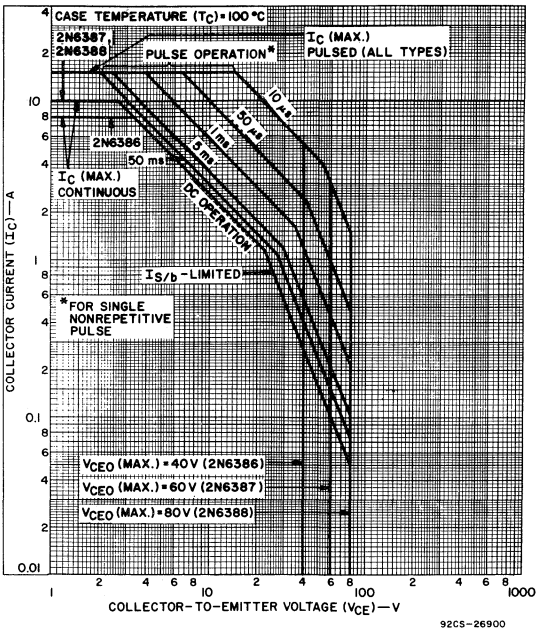


Fig. 17 - Maximum operating areas for 2N6386–2N6388 at T_C = 100°C.

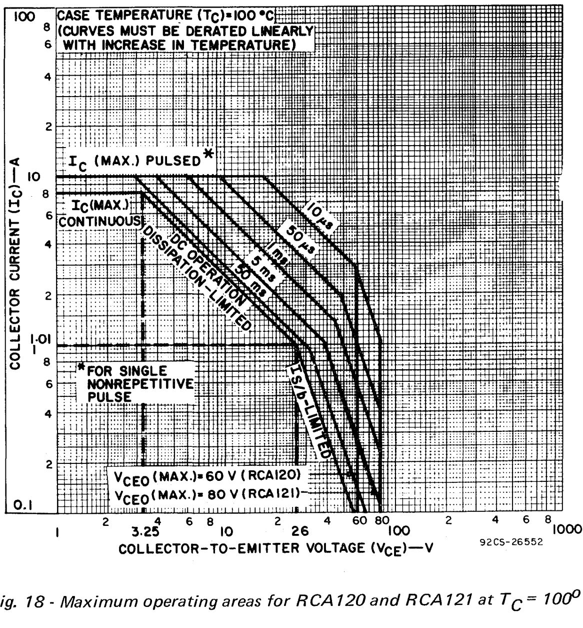


Fig. 18 - Maximum operating areas for RCA120 and RCA121 at T_C = 100°C.

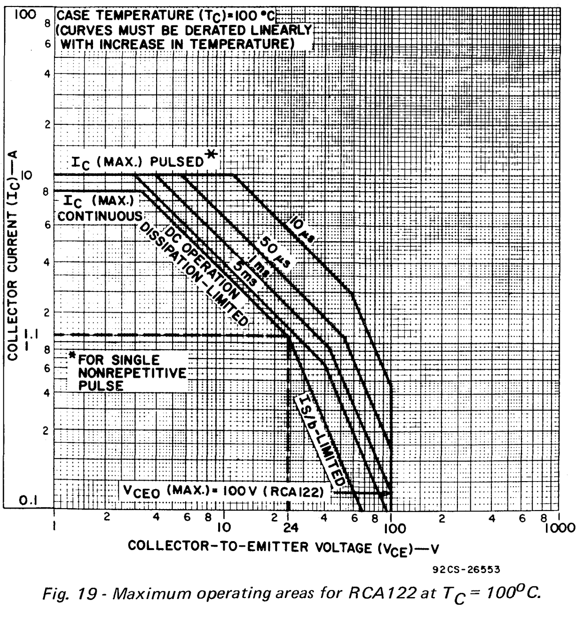


Fig. 19 - Maximum operating areas for RCA122 at T_C = 100°C.

2N6477, 2N6478, RCA3441, RCA6263

Hometaxial-Base, Medium-Power Silicon N-P-N Transistors

Designed for Medium-Power Linear and Switching Service in Consumer, Automotive, and Industrial Applications

RCA 2N6477 and 2N6478 are hometaxial-base silicon n-p-n transistors intended for a wide variety of medium-to-high power, high-voltage applications. These devices, which are voltage extensions of the 2N5298 family, are especially useful in vertical output stages in color and black-and-white TV. The units differ in voltage ratings and in the currents at which parameters are controlled.

RCA3441 and RCA6263 are silicon n-p-n transistors intended for a wide variety of high-current applications. The hometaxial-base construction of these devices renders them highly resistant to second breakdown over a wide range of operating conditions. The VERSAWATT case has a proven thermal-cycling capability. This capability is assured by real-time quality controls in our manufacturing locations. All these types are supplied in the JEDEC TO-220AB straight-lead version of the package. They are also available on special order in a variety of lead-form configurations. Two popular variations have leads formed to fit TO-66 sockets (specify formed lead No. 6201) or printed-circuit boards (specify formed lead No. 6207). Detailed information on these and other VERSAWATT outlines may be obtained from your RCA Sales Office.

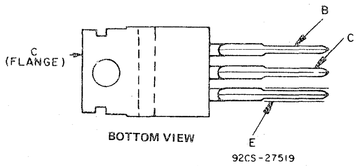
Features:

- Maximum safe-area-of-operation curves
- Low saturation voltages
- High dissipation ratings
- Thermal-cycling rating curves

Applications:

- **Series and shunt regulators**
- **High-fidelity amplifiers**
- **Power switching circuits**
- **Solenoid drivers**
- **Vertical output stages in color and B/W TV**

TERMINAL DESIGNATIONS



JEDEC TO-220AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		2N6477	2N6478	RCA6263	RCA3441	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	140	160	140	160	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE						
With external base-to-emitter resistance (R_{BE}) = 100 Ω	$V_{CER}(sus)$	120	140	120	140	V
With base open	$V_{CEO}(sus)$	130	150	130	150	V
With base reverse-biased V_{BE} = −1 5 V	$V_{CEV}(sus)$	140	160	140	160	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	5	7	7	V
CONTINUOUS COLLECTOR CURRENT	I_C	2.5	2.5	3	3	A
PEAK COLLECTOR CURRENT		4	4	4	4	A
CONTINUOUS BASE CURRENT	I_B	1	1	2	2	A
TRANSISTOR DISSIPATION:	P_T					
At case temperatures up to 25°C		50	50	36	36	W
At case temperatures above 25°C		Derate linearly to 150°C				
		1.8	1.8	—	—	W
		Derate linearly at 0.0144		—	—	W/°C
TEMPERATURE RANGE:						
Storage and Operating (Junction)				−65 to 150		°C
PIN TEMPERATURE (During Soldering)						
At distances ≥ 1/32 in. (0 8 mm) from seating plane for 10 s max.				235		°C

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* 2N- Series types in accordance with JEDEC registration data format JS-6 RDF-2.

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS VOLTAGE V dc V_{CE}	TEST CONDITIONS VOLTAGE V dc V_{BE}	TEST CONDITIONS CURRENT A dc I_C	TEST CONDITIONS CURRENT A dc I_B	LIMITS 2N6477 MIN.	LIMITS 2N6477 MAX.	LIMITS 2N6478 MIN.	LIMITS 2N6478 MAX.	UNITS
* Collector-Cutoff Current: With base open	I_{CEO}	80 100			0 0	– –	2 –	– –	– 2	mA
With base-emitter junction reverse-biased	I_{CEV}	130 150	−1.5 −1.5			– –	2 –	– –	– 2	
At T_C = 150°C	I_{CEV}	120 140	−1.5 −1.5			– –	10 –	– –	– 10	
* Emitter-Cutoff Current	I_{EBO}		−5	0		–	2	–	2	mA
* Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$			0.1[a]	0	120	–	140	–	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	$V_{CER}(sus)$			0.1[a]		130	–	150	–	
With base-emitter junction reverse-biased	$V_{CEV}(sus)$		−1.5	0.1[a]		140	–	160	–	
* DC Forward-Current Transfer Ratio	h_{FE}	4 4		1[a] 2.5[a]		25 5	150 –	25 5	150 –	
* Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$			1[a] 2.5[a]	0.1 0.5	– –	1 2	– –	1 2	V
* Base-to-Emitter Voltage	V_{BE}	4 4		1[a] 2.5[a]		– –	1.8 3	– –	1.8 3	V
* Magnitude of Common-Emitter, Small-Signal, Short-Circuit Forward-Current Transfer Ratio: f = 40 kHz	$\lvert h_{fe} \rvert$	4		0.5		5	–	5	–	
Gain-Bandwidth Product	f_T	4		0.5		200	–	200	–	kHz
* Common-Emitter, Small-Signal, Short-Circuit Forward-Current Transfer Ratio: f = 1 kHz	h_{fe}	4		0.1		25	–	25	–	
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$					–	2.5	–	2.5	°C/W
Junction-to-Ambient	$R_{\theta JC}$					–	70	–	70	

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* In accordance with JEDEC registration data format (JS-6 RDF-2).

[a] Pulsed: Pulse duration = 300 μs, duty factor = 1.8%.

CAUTION: The sustaining voltage $V_{CEO}(sus)$, $V_{CER}(sus)$, and $V_{CEV}(sus)$ MUST NOT be measured on a curve tracer.

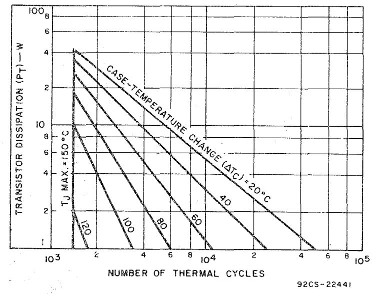


Fig. 1 - Thermal-cycling rating chart for 2N6477, 2N6478.

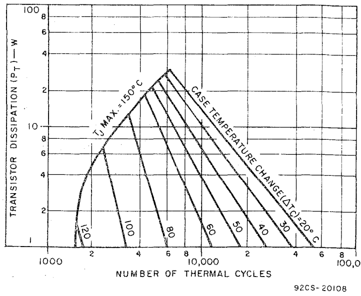


Fig. 2 - Thermal-cycling rating chart for RCA3441, RCA6263.

2N6477, 2N6478, RCA3441, RCA6263

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS					LIMITS				UNITS
		VOLTAGE V dc			CURRENT A dc		RCA6263		RCA3441		
		V_{CE}	V_{EB}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	
Collector-Cutoff Current: With base open	I_{CEO}	100 120				0 0	– –	5 –	– –	– 5	mA
With base-emitter junction reverse-biased	I_{CEX}	120 140		−1.5 −1.5			– –	5 –	– –	– 5	
At T_C = 150°C	I_{CEX}	120 140		−1.5 −1.5			– –	10 –	– –	– 10	
Emitter-Cutoff Current	I_{EBO}		5		0		–	2	–	2	mA
Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$				0.1^a	0	120	–	140	–	
With external base-to-emitter resistance (R_{BE}) = 100 Ω	$V_{CER}(sus)$				0.1^a		130	–	150	–	V
With base-emitter junction reverse-biased	$V_{CEV}(sus)$			−1.5	0.1^a		140	–	160	–	
DC Forward-Current Transfer Ratio	h_{FE}	4			0.5^a		20	150	20	150	
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$				0.5^a	0.05^a	–	1.2	–	1.2	V
Base-to-Emitter Voltage	V_{BE}	4			0.5^a		–	2	–	2	V
Gain-Bandwidth Product	f_T	4			0.2		200	–	200	–	kHz
Common-Emitter, Small-Signal, Short-Circuit Forward-Current Transfer Ratio (f = 1 kHz)	h_{fe}	4			0.1		25	–	25	–	
Forward-Bias Second Breakdown Collector Current^b (t ≥ 1 s)	$I_{S/b}$	120					0.3	–	0.3	–	A
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$						–	3.5	–	3.5	°C/W
Junction-to-Ambient	$R_{\theta JA}$						–	70	–	70	

^{a}Pulsed: Pulse duration = 300 μs, duty factor = 1.8%. ^{b}Pulsed: 1-second non-repetitive pulse.

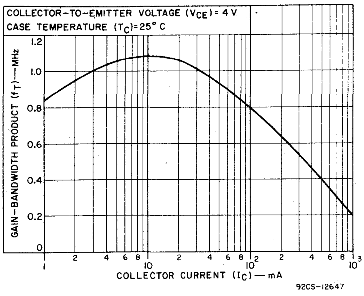


Fig. 3 - Typical gain-bandwidth product for all types.

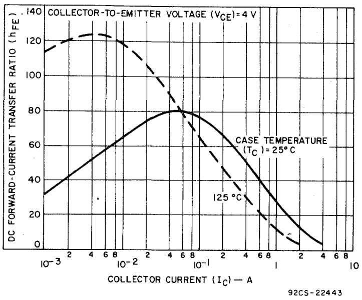


Fig. 4 - Typical dc beta characteristics for 2N6477.

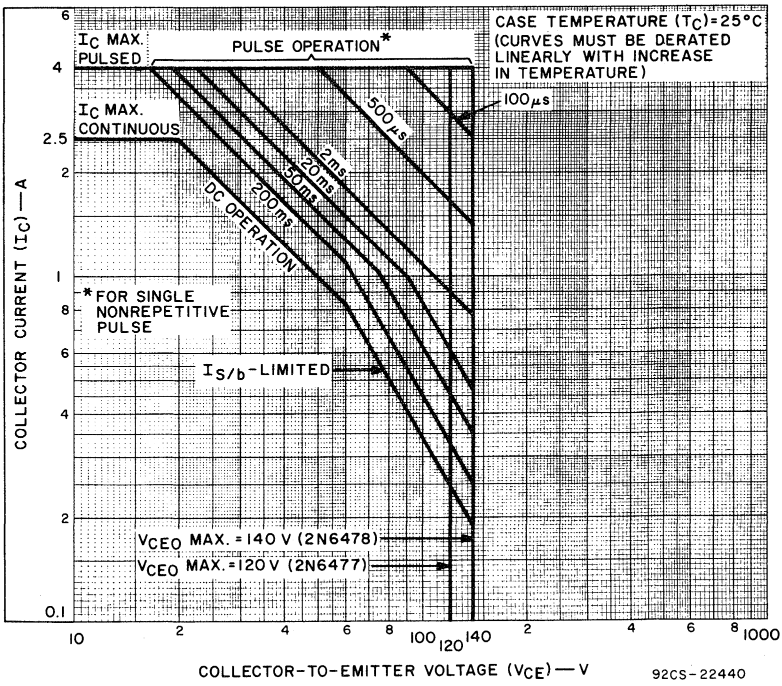


Fig. 6 - Maximum operating areas for 2N6477 and 2N6478.

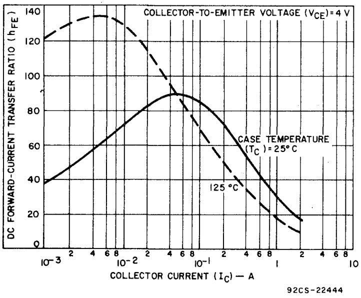


Fig. 5 - Typical dc beta characteristics for 2N6478.

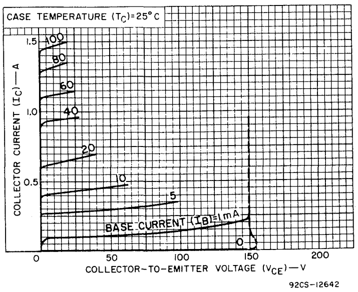
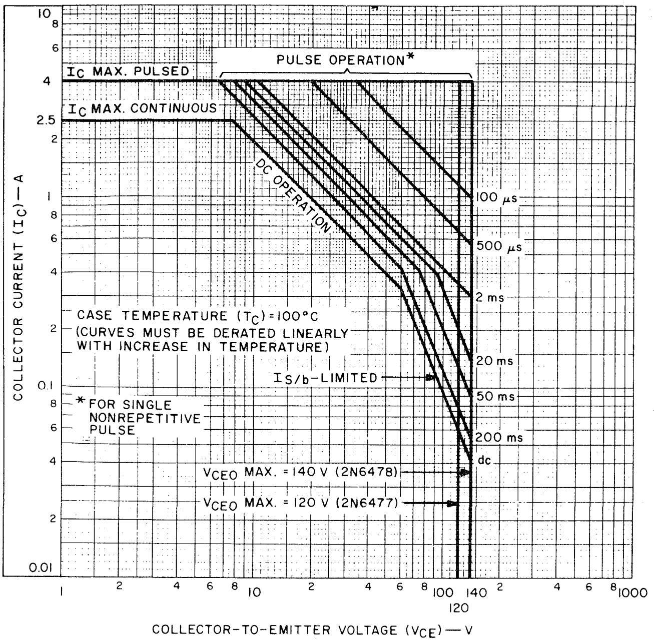


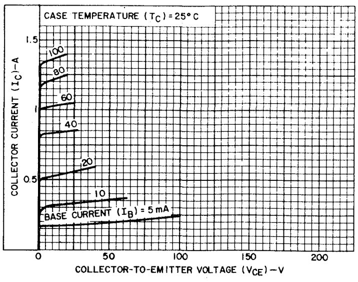
Fig. 7 - Typical output characteristics for 2N6478 and RCA3441.

2N6477, 2N6478, RCA3441, RCA6263



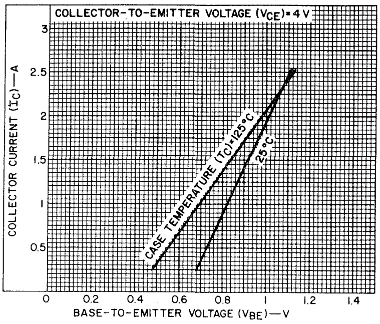
92CS-22442

Fig. 8 - Maximum operating areas for 2N6477 and 2N6478.



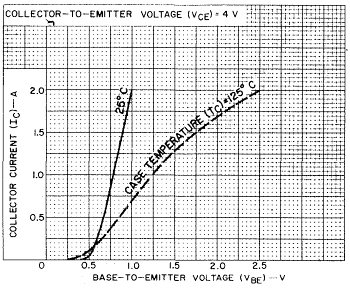
92CS-19515

Fig. 9 - Typical output characteristics for 2N6477 and RCA6263.



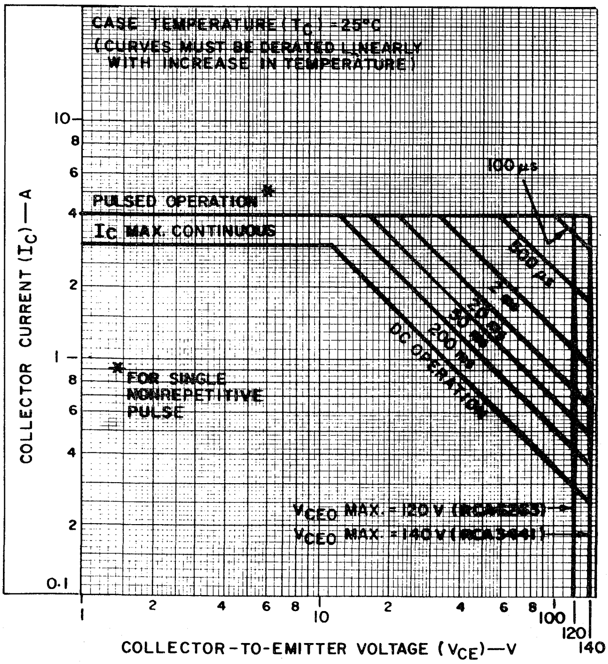
92CS-27756

Fig. 10 - Typical transfer characteristics for 2N6477 and 2N6478.



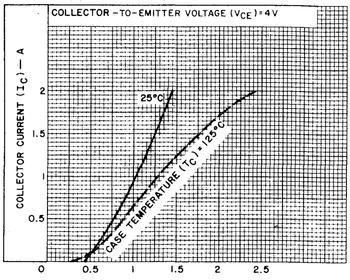
92CS-12643

Fig. 12 - Typical transfer characteristics for RCA3441.



92CS-22280

Fig. 11 - Maximum operating areas for RCA3441, RCA6263.



92CS-19512

Fig. 13 - Typical transfer characteristics for RCA6263.

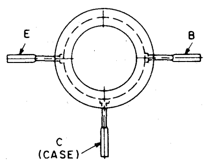
2N6479-2N6482

Radiation-Hardened Silicon N-P-N Power Transistors

Epitaxial-Planar Types for Aerospace and Military Applications

Rated for Operation in Radiation Environments
with Cumulative Neutron Fluence Levels to 1 x 10^{14} Neutrons/cm^2
and Gamma Intensity to 1 x 10^8 Rad(Si)/s

TERMINAL DESIGNATIONS



TOP VIEW

RADIAL

RCA types 2N6479, 2N6480, 2N6481, and 2N6482● are epitaxial silicon n-p-n planar power-switching transistors. They are designed for aerospace applications in which they might be subjected to extreme neutron and gamma-ray exposure.

The 2N6479, 2N6480, 2N6481, and 2N6482 are intended for use in 5-to-10 ampere high-frequency power inverter service. Types 2N6479 and 2N6481 differ from types 2N6480 and 2N6482, respectively, in voltage and power ratings. In types 2N6479 and 2N6480, the collector is isolated from the case.

● Formerly RCA Dev. Nos. TA8007, TA8007B, TA8100, and TA8100B, respectively.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		2N6479	2N6480	2N6481	2N6482	
* COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	100	100	100	100	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:						
* With external base-to-emitter resistance (R_{BE}) $\leq$ 100 Ω	$V_{CER}(sus)$	80	100	80	100	V
With base open	$V_{CEO}(sus)$	60	80	60	80	V
* EMITTER-TO-BASE VOLTAGE	V_{EBO}	6	6	6	6	V
* CONTINUOUS COLLECTOR CURRENT	I_C	12	12	12	12	A
* PEAK COLLECTOR CURRENT		25	25	25	25	A
* CONTINUOUS BASE CURRENT	I_B	5	5	5	5	A
* TRANSISTOR DISSIPATION:	P_T					
At case temperatures up to 25°C		87	87	117	117	W
At case temperatures above 25°C		See Figs. 1, 3, and 11				
* TEMPERATURE RANGE:						
Storage and Operating (Junction)		-65 to +200				°C
* TERMINAL TEMPERATURE (During Soldering):						
At distance $\geq$ 1/32 in. (0.8 mm) from seating plane for 10 s max.		230				°C

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* In accordance with JEDEC registration data format JS-6 RDF-1.

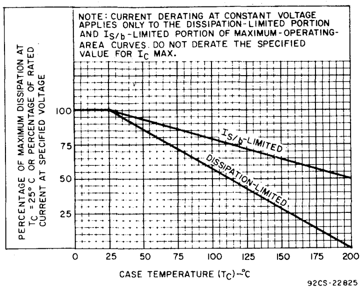


Fig. 1 - Derating curves for all types.

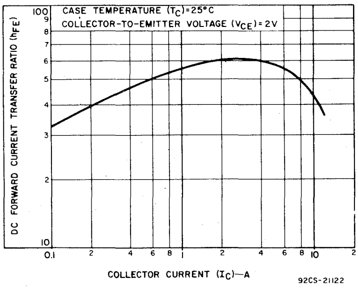


Fig. 2 - Typical dc beta characteristic for all types.

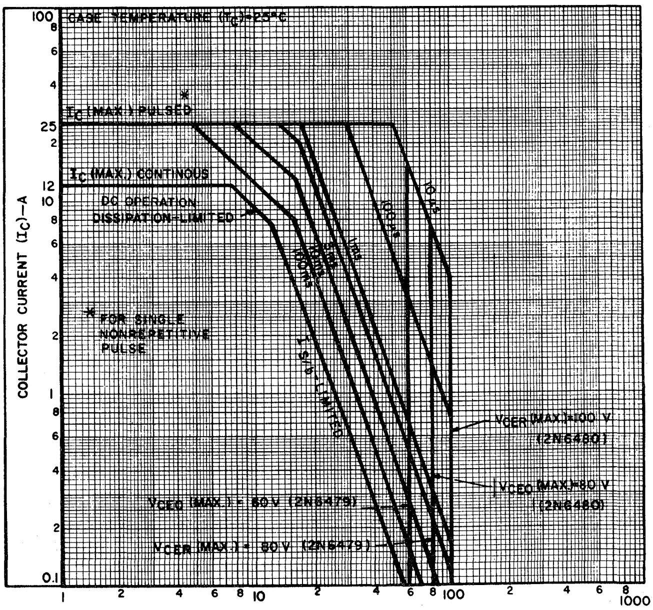


Fig. 3 - Maximum operating areas for 2N6479 and 2N6480.

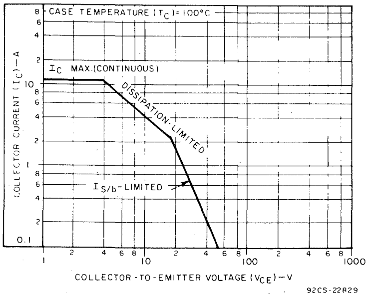


Fig. 4 - Maximum operating area for 2N6479 and 2N6480 at 100°C case temperature.

2N6479-2N6482

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C*
PRE-RADIATION

	CHARACTERISTIC	SYMBOL	TEST CONDITIONS VOLTAGE V dc		TEST CONDITIONS CURRENT A dc		LIMITS 2N6479 2N6481		LIMITS 2N6480 2N6482		UNITS
			V_{CE}	V_{EB}	I_B	I_C	MIN.	MAX.	MIN.	MAX.	
	Collector Cutoff Current: With emitter open, V_{CB} = 100 V	I_{CBO}					–	1	–	1	mA
	With base shorted	I_{CES}	60				–	200	–	200	μA
*	With base-emitter junction reverse-biased	I_{CEV}	100	0			–	1	–	1	mA
*	At T_C = 100°C		60	0			–	1	–	1	
*	Emitter Cutoff Current	I_{EBO}		6			–	2	–	2	mA
	Emitter-to-Base Voltage: I_E = 2 mA	V_{EBO}					6	–	6	–	V
*	Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$				0.2[a]	60[b]	–	80[b]	–	V
	With external base-to-emitter resistance (R_{BE}) = 100 Ω	$V_{CER}(sus)$				0 2	80[b]	–	100[b]	–	
*	Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$			1.2	12[a]	-	0.75	–	0.75	V
*	Base-to-Emitter Saturation Voltage	$V_{BE}(sat)$			1.2	12[a]	–	1.5	–	1.5	V
*	DC Forward Current Transfer Ratio	h_{FE}	2			12[a]	20	300	20	300	
	Second Breakdown Collector Current: With base forward-biased, t = 1 s	$I_{S/b}$	12				7.3	·	7.3	–	A
	Second Breakdown Energy: With base reverse-biased, R_{BE} = 100 Ω, L = 100 μH	$E_{S/b}$**				5	1.25		1.25		mJ
*	Saturated Switching Time (V_{CC} = 30 V, I_{B1} = I_{B2}): Rise	t_r			1.2	12		400	–	400	ns
	Storage	t_s			1.2	12	-	800	–	800	
	Fall	t_f			1.2	12	–	200	–	200	
*	Magnitude of Common Emitter Small-Signal Short Circuit Forward Current Transfer Ratio: f = 10 MHz	$\|h_{fe}\|$	5			1	10	-	10	–	
	Collector-to-Base Feedback Capacitance: V_{CB} = 10 V, f = 1 MHz	C_{ob}					–	400	–	400	pF
							2N6479 2N6480		2N6481 2N6482		
	Thermal Resistance: Junction-to-Case	$R_{\theta JC}$	10			5	–	2	–	1.5	°C/W

* In accordance with JEDEC registration data format JS-6 RDF-1.
[a] Pulsed; pulse duration ≤ 350 μs, duty factor ≤ 2%.
[b] CAUTION: The sustaining voltages $V_{CEO}(sus)$ and $V_{CER}(sus)$ MUST NOT be measured on a curve tracer.

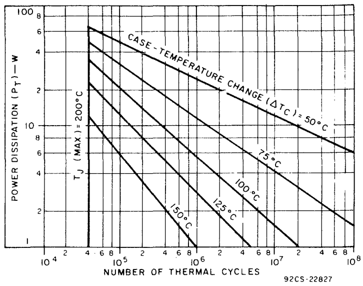


Fig. 5 - Thermal-cycling rating chart for 2N6479 and 2N6480.

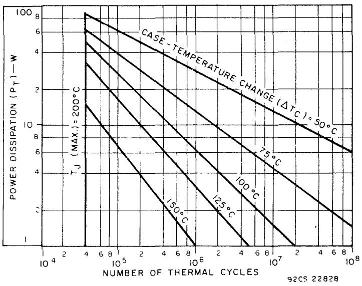
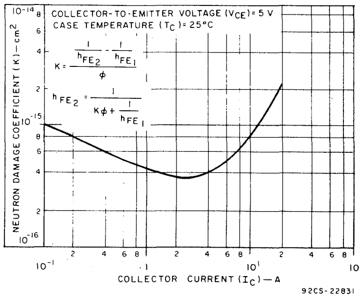


Fig. 6 - Thermal-cycling rating chart for 2N6481 and 2N6482.



$$K = \frac{\frac{1}{h_{FE_2}} - \frac{1}{h_{FE_1}}}{\phi}$$

$$h_{FE_2} = \frac{1}{K\phi + \frac{1}{h_{FE_1}}}$$

Fig. 7 - Typical 1-MeV-equivalent neutron damage coefficient as a function of collector current for all types.

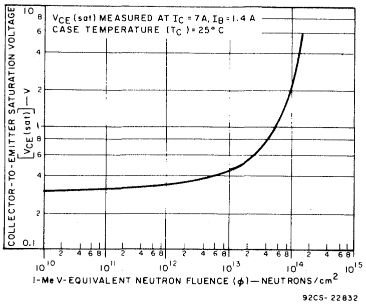


Fig. 8 - Typical collector-to-emitter saturation voltage as a function of 1-MeV-equivalent neutron fluence for all types.

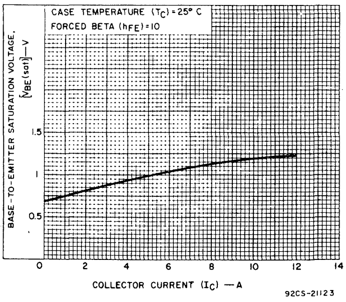


Fig. 9 - Typical base-to-emitter saturation voltage characteristic for all types.

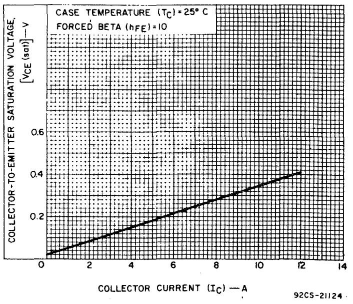


Fig. 10 - Typical collector-to-emitter saturation voltage characteristic for all types.

POST-NEUTRON-RADIATION ELECTRICAL CHARACTERISTICS
AFTER EXPOSURE TO 5 x 10^{13} NEUTRONS/cm^2 (1 MeV equiv.), *At Case Temperature (T_C) = 25°C*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS		UNITS
		VOLTAGE V dc		CURRENT A dc		For all Types		
		V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	
*Collector Cutoff Current: With base-emitter junction reverse-biased	I_{CEV}	100	0			–	1.2	mA
*Emitter Cutoff Current	I_{EBO}		–5			–	2.2	mA
*Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$			0.2 0.2	– –	80[b] 60[c]	– –	V
*Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$			7[a]	1.4	–	1.5	V
*Base-to-Emitter Saturation Voltage	$V_{BE}(sat)$			7[a]	1.4	–	1.5	V
*DC Forward Current Transfer Ratio	h_{FE}	5		7[a]		12	–	
Magnitude of Common Emitter, Small-Signal Short Circuit Forward Current Transfer Ratio: Ratio (f = 10 MHz)	$\|h_{fe}\|$	5		1		10	–	
*Damage Constant	K▲					–	9 x 10^{-16}	

* In accordance with JEDEC registration data format JS-6 RDF-1.

a Pulsed; pulse duration ≤ 350 µs, duty factor ≤ 2%.

b For types 2N6480, 2N6482.

c For types 2N6479, 2N6481.

▲Damage constant $K = \dfrac{\dfrac{1}{h_{FE_2}} - \dfrac{1}{h_{FE_1}}}{\phi}$

Where h_{FE_1} = Beta prior to exposure
h_{FE_2} = Beta after exposure
ϕ = Neutron fluence (1 MeV equiv.)

Knowing K, h_{FE_2} may be calculated for other fluences using the relationship:

$$h_{FE_2} = \frac{1}{K\phi + \dfrac{1}{h_{FE_1}}}$$

TYPICAL CHARACTERISTIC DURING GAMMA EXPOSURE FOR DOSE RATES OF LESS THAN 1 x 10^8 RAD(Si)/sec

CHARACTERISTIC	SYMBOL	TEST CONDITIONS		LIMITS	UNITS
		VOLTAGE – V dc		For all Types	
		V_{CB}	V_{BE}	TYPICAL	
Collector-to-Base Charge Generation Constant	(C)	20	0	5x10^{-8}	$\frac{\text{Coulomb}}{\text{Rad}}$

The charge generated in the depletion region of a transistor is proportional to the volume of the depletion region, the total dose, and the energy of the gamma radiation.

The primary base-collector photo current $[I_{pp(base)}]$ = (C)$\dot{\gamma}$, where $\dot{\gamma}$ is the gamma dose rate in Rad(Si)/s.

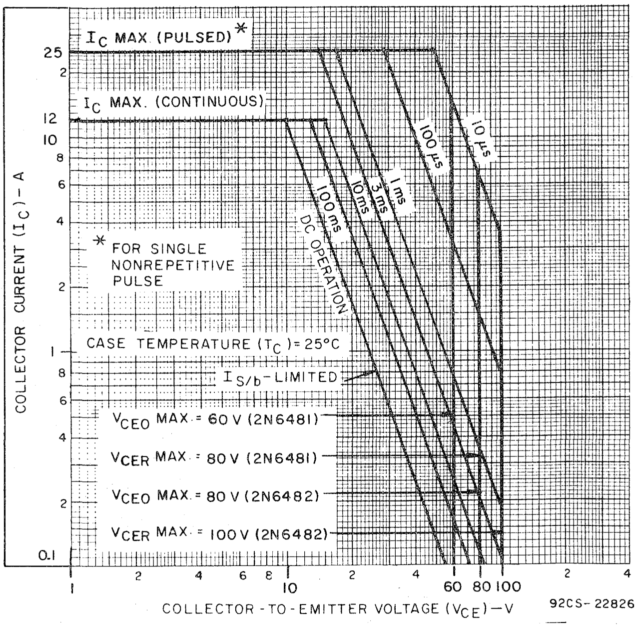


Fig. 11 - Maximum operating areas for 2N6481 and 2N6482.

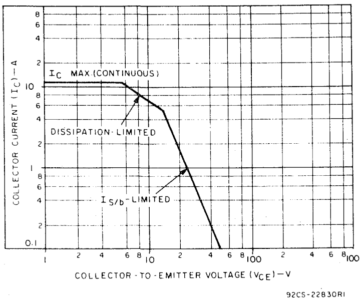


Fig. 12 - Maximum operating area for 2N6481 and 2N6482.

2N6486-2N6491

15-A, 75-W, Silicon N-P-N and P-N-P Epitaxial-Base VERSAWATT Transistors

Complementary Pairs for General-Purpose Switching and Amplifier Applications

Features:

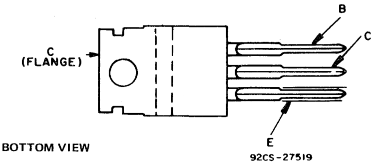
- Thermal-cycling ratings
- Maximum safe-area-of-operation curves
- Color-coded packages of molded-silicone plastic:
  - Green – p-n-p (2N6489, 2N6490, 2N6491)
  - Gray – n-p-n (2N6486, 2N6487, 2N6488)

RCA-2N6486–2N6491●, inclusive, are epitaxial-base silicon transistors. The 2N6486, 2N6487, and 2N6488 are n-p-n complements of p-n-p types 2N6489, 2N6490, and 2N6491, respectively. All these devices are intended for a wide variety of medium-power switching and amplifier applications, and are particularly useful in high-fidelity amplifiers utilizing complementary-symmetry circuits.

These devices are supplied in the RCA VERSAWATT package in color-coded molded-silicone plastic; the 2N6489–2N6491 (p-n-p) devices are green, and the 2N6486–2N6488 (n-p-n) devices are gray. All are regularly supplied in the JEDEC TO-220AB straight-lead version of the package. They are also available on special order in a variety of lead-form configurations.

● Formerly RCA Dev. Nos. TA8325, TA8324, TA8323, TA8328, TA8327, and TA8326, respectively.

TERMINAL DESIGNATIONS



JEDEC TO-220AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		N-P-N P-N-P	2N6486 2N6489◆	2N6487 2N6490◆	2N6488 2N6491◆	
* COLLECTOR-TO-BASE VOLTAGE	V_{CBO}		50	70	90	V
COLLECTOR-TO-EMITTER VOLTAGE:						
* With 1.5 volts (V_{BE}) of reverse bias, and external base-to-emitter resistance (R_{BE}) = 100 Ω	V_{CEX}		50	70	90	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	V_{CER}		45	65	85	V
With base open	V_{CEO}		40	60	80	V
* EMITTER-TO-BASE VOLTAGE	V_{EBO}		5	5	5	V
* CONTINUOUS COLLECTOR CURRENT	I_C		15	15	15	A
* CONTINUOUS BASE CURRENT	I_B		5	5	5	A
* TRANSISTOR DISSIPATION:	P_T					
At case temperatures up to 25°C			75	75	75	W
At ambient temperatures up to 25°C			1.8	1.8	1.8	W
At case temperatures above 25°C			Derate linearly 0.6			W/° C
At ambient temperatures above 25°C			Derate linearly 0.0144			W/° C
* TEMPERATURE RANGE:						
Storage and operating (Junction)			–65 to +150			°C
* LEAD TEMPERATURE (During soldering):						
At distance ≥ 1/8 in. (3.17 mm) from seating plane for 10 s max.			235			°C

* In accordance with JEDEC registration data format JS-6 RDF-2.

◆ For p-n-p devices, voltage and current values are negative.

ELECTRICAL CHARACTERISTICS, *At case temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS			LIMITS						UNITS
		VOLTAGE V dc		CURR. A dc	2N6486 2N6489◆		2N6487 2N6490◆		2N6488 2N6491◆		
		V_{CE}	V_{BE}	I_C	Min.	Max.	Min.	Max.	Min.	Max.	
Collector-Cutoff Current: With external base-emitter resistance (R_{BE}) = 100Ω	I_{CER}	35 55 75			– – –	500 – –	– – –	– 500 –	– – –	– – 500	μA
* With base-emitter junction reverse biased and external base-to-emitter resistance (R_{BE}) = 100Ω	I_{CEX}	45 65 85	–1.5 –1.5 –1.5		– – –	500 – –	– – –	– 500 –	– – –	– – 500	μA
* At T_C = 150°C		40 60 80	–1.5 –1.5 –1.5		– – –	5 – –	– – –	– 5 –	– – –	– – 5	mA
* With base open	I_{CEO}	20 30 40			– – –	1 – –	– – –	– 1 –	– – –	– – 1	mA
* Emitter-Cutoff Current	I_{EBO}		– 5	0	–	1	–	1	–	1	mA
* DC Forward-Current Transfer Ratio	h_{FE}	4 4		5^a 15^a	20 5	150 –	20 5	150 –	20 5	150 –	
* Collector-to-Emitter Sustaining Voltage With base open	$V_{CEO}(sus)$			0.2	40^b	-	60^b		80^b		V
With external base-emitter resistance (R_{BE}) = 100Ω	$V_{CER}(sus)$			0.2	45^b	–	65^b		85^b		
With base-emitter junction reverse-biased and external base-to-emitter resistance (R_{BE}) = 100Ω	$V_{CEX}(sus)$		1.5	0.2	50^b		70^b		90^b		
* Base-to-Emitter Voltage	V_{BE}	4 4		5^a 15^a	- -	1.3 3.5	 –	1.3 3.5	– –	1.3 3.5	V
* Collector-to-Emitter Saturation Voltage [I_B = 0.5 A I_B = 5 A]	$V_{CE}(sat)$			5^a 15^a	– –	1.3 3.5	– –	1.3 3.5	– –	1.3 3.5	V
* Magnitude of Common-Emitter Small-Signal Short-Circuit Forward-Current Transfer Ratio: f = 1 MHz	$\|h_{fe}\|$	4		1	5	–	5	-	5	–	
* Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f = 1 kHz)	h_{fe}	4		1	25	–	25	–	25	–	
Thermal Resistance: Junction-to-case	$R_{\theta JC}$				–	1.67	–	1.67	–	1.67	°C/W
Junction-to-ambient	$R_{\theta JA}$				–		–	70	–	70	

* In accordance with JEDEC registration data format (JS-6 RDF-2).

[a] Pulsed; pulse duration = 300 μs, duty factor = 1.8%

[b] *CAUTION: Sustaining voltages $V_{CEO}(sus)$, $V_{CER}(sus)$, and $V_{CEX}(sus)$ MUST NOT be measured on a curve tracer. (See Fig. 19)*

◆ For p-n-p devices, voltage and current values are negative.

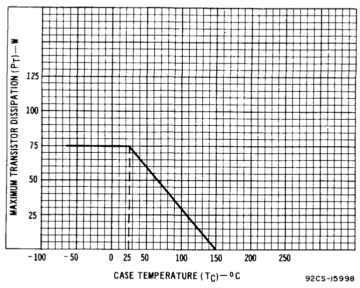


Fig. 1 - Derating chart for all types.

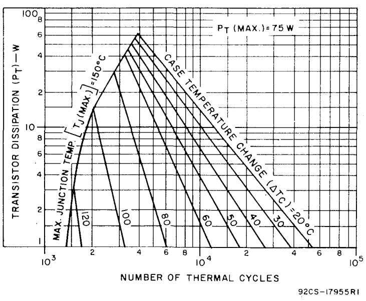


Fig. 2 - Thermal-cycling rating chart for all types.

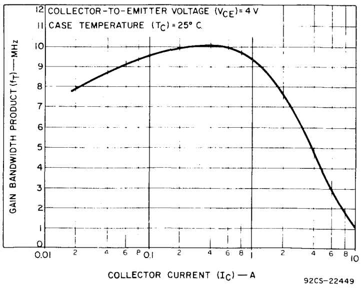


Fig. 3 - Typical gain-bandwidth product as a function of collector current for all types.◆

◆ For p-n-p devices, voltage and current values are negative.

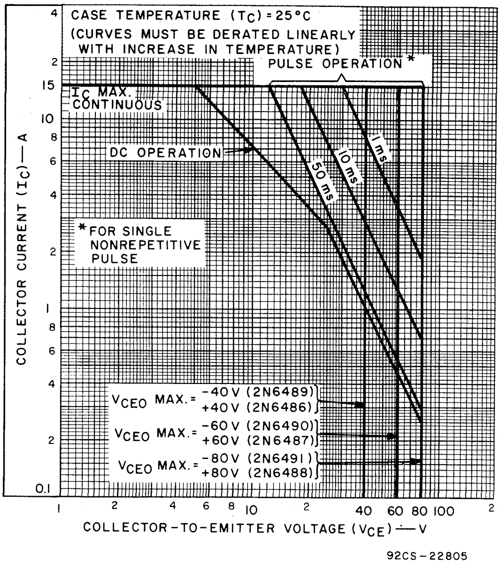


Fig. 4 - Maximum operating areas for all types.◆

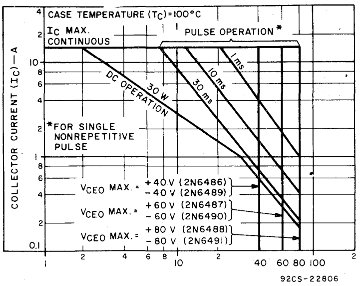


Fig. 5 - Maximum operating areas for all types.◆

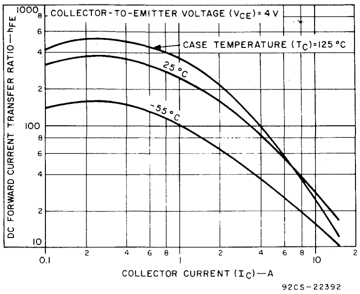


Fig. 6 - Typical dc beta characteristics for 2N6486, 2N6487, and 2N6488.

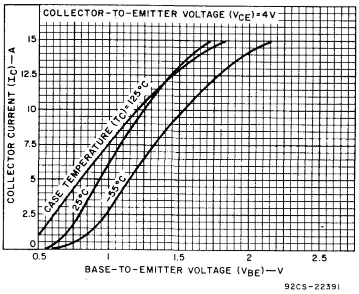


Fig. 7 - Typical transfer characteristics for all types.◆

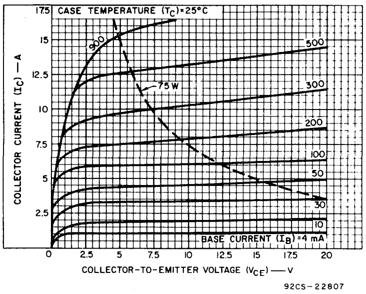


Fig. 8 - Typical output characteristics for all types.◆

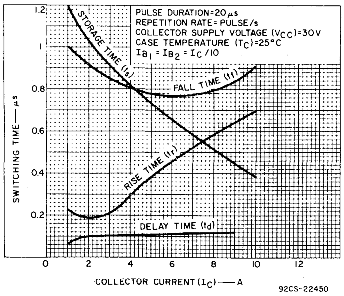


Fig. 9 - Typical saturated switching characteristics for 2N6486, 2N6487, and 2N6488.

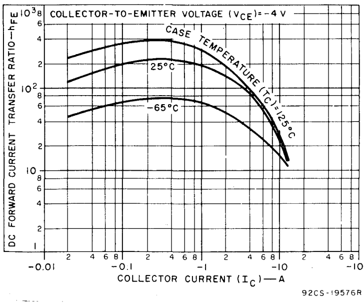


Fig. 10 - Typical dc beta characteristics for 2N6489, 2N6490, 2N6491.

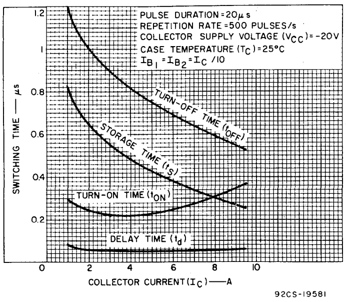


Fig. 11 - Typical saturated switching characteristics for 2N6489, 2N6490, and 2N6491.

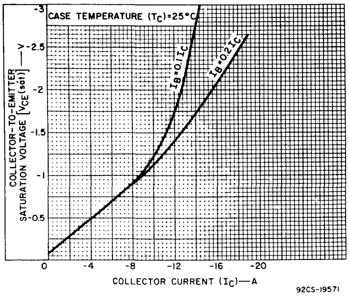


Fig. 12 - Typical collector-to-emitter saturation-voltage characteristics for all types.

◆ For p-n-p devices, voltage and current values are negative.

2N6510-2N6514

High-Voltage, High-Current Silicon N-P-N Power-Switching Transistors

For Switching Applications in Industrial
Commercial and Military Equipment

Features:

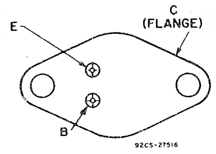
- Fast switching speed
- Epitaxial pi-nu construction
- Hermetic steel package—JEDEC TO-3
- Maximum-safe-area-of-operation curves
- Thermal-cycling rating chart

The RCA-2N6510, -2N6511, -2N6512, -2N6513, and -2N6514● are epitaxial silicon n-p-n power transistors with pi-nu construction. They are especially designed for use in electronic ignition circuits and other applications requiring high-voltage, high-energy, and fast-switching-speed capability.

These devices are hermetically sealed in a steel JEDEC TO-3 package. They differ from each other in breakdown-voltage ratings, leakage, and beta characteristics.

●Formerly RCA Dev. Nos. TA8847D, TA8847A, TA8847B, TA8847C, and TA8847E, respectively.

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		2N6510	2N6511	2N6512	2N6513	2N6514	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	250	300	350	400	350	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:							
With external base-to-emitter resistance R_{BE} = 50 Ω	$V_{CER}(sus)$	250	300	350	400	350	V
* With base open	$V_{CEO}(sus)$	200	250	300	350	300	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	6	6	6	6	6	V
*CONTINUOUS COLLECTOR CURRENT	I_C	7	7	7	7	7	A
*CONTINUOUS BASE CURRENT	I_B	3	3	3	3	3	A
*EMITTER CURRENT	I_E	10	10	10	10	10	A
*TRANSISTOR DISSIPATION:	P_T						
At case temperatures up to 25°C		120	120	120	120	120	W
At case temperatures above 25°C		See Figs. 1 and 2.					
*TEMPERATURE RANGE:							
Storage and Operating (Junction)		−65 to +200					°C
*PIN TEMPERATURE (During Soldering):							
At distances ⩾ 1/32 in. (0.8 mm) from seating plane for 10 s max.		230					°C

*In accordance with JEDEC registration data format JC-25 RDF-1.

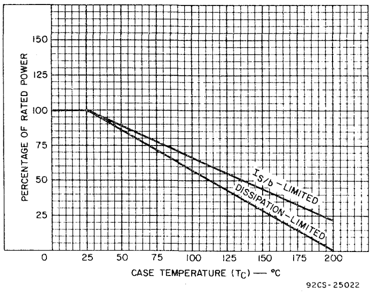


Fig. 2 - Derating curve for all types.

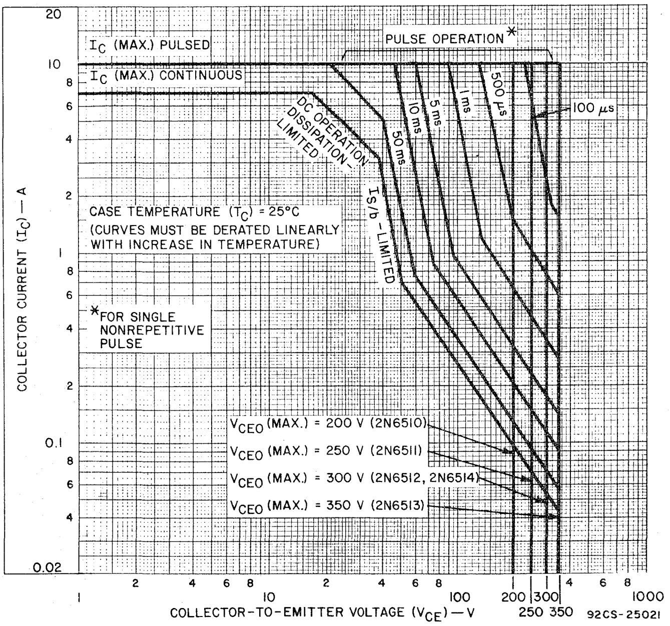


Fig. 1 - Maximum operating areas for all types.

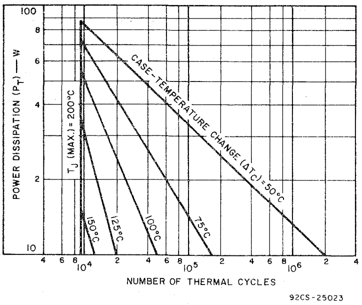


Fig. 3 - Thermal-cycling rating chart for all types.

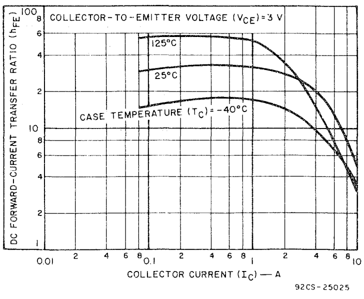


Fig. 4 - Typical dc beta characteristic for all types.

2N6510-2N6514

ELECTRICAL CHARACTERISTICS, *Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS						UNITS
		VOLTAGE V dc		CURRENT A dc		2N6512 2N6514			2N6513			
		V_{CE}	V_{BE}	I_C	I_B	Min.	Typ.	Max.	Min.	Typ.	Max.	
Collector-Cutoff Current: With base open	I_{CEO}	250 300				– –	– –	5 –	– –	– –	– 5	mA
* With base-emitter junction reverse biased	I_{CEV}	350 400	−1.5 −1.5			– –	– –	5 –	– –	– –	– 5	mA
* With base-emitter junction reverse biased, T_C = 100°C		350 400	−1.5 −1.5			– –	– –	10 –	– –	– –	– 10	
* Emitter-Cutoff Current	I_{EBO}		−6			–	–	3	–	–	3	mA
Collector-to-Emitter Sustaining Voltage: * With base open	V_{CEO}(sus)			0.2		300[b]	–	–	350[b]	–	–	V
With external base-to-emitter resistance: R_{BE} = 50 Ω	V_{CER}(sus)			0.2		350[b]	–	–	400[b]	–	–	
* Emitter-to-Base Voltage: I_E = 3 mA	V_{EBO}					6	–	–	6	–	–	V
* DC Forward-Current Transfer Ratio: 2N6512, 2N6513 2N6514	h_{FE}	3 3		4[a] 5[a]		10 10	– –	50 50	10 –	– –	50 –	
* Base-to-Emitter Saturation Voltage: 2N6512, 2N6513 2N6514	V_{BE}(sat)			4[a] 5[a]	0.8 1	– –	– –	1.7 1.7	– –	– –	1.7 –	V
* Collector-to-Emitter Saturation Voltage: 2N6512, 2N6513 2N6514 All types	V_{CE}(sat)			4[a] 5 7	0.8 1 3	– – –	– – 1.5	1.5 1.5 2.5	– – –	– – 1.5	1.5 – 2.5	V
* Output Capacitance: V_{CB} = 10 V, f = 1 MHz	C_{obo}					100	–	200	100	–	200	pF
* Magnitude of Common Emitter, Small-Signal Short-Circuit, Forward-Current Transfer Ratio: f = 1 MHz	$\|h_{fe}\|$	10		1		3	–	9	3	–	9	MHz
* Forward-Bias, Second-Breakdown Collector Current: t = 1 s, nonrepetitive	$I_{S/b}$	38 200				3.16 0.1	– –	– –	3.16 0.1	– –	– –	A
* Switching Time:[c] (V_{CC} = 200 V, I_{B1} = I_{B2}): Delay Time: 2N6512, 2N6513 2N6514	t_d			4 5	0.8 1	– –	0.1 0.1	0.2 0.2	– –	0.1 –	0.2 –	µs
Rise Time: 2N6512, 2N6513 2N6514	t_r			4 5	0.8 1	– –	0.7 0.7	1.5 1.5	– –	0.7 –	1.5 –	
Storage Time: 2N6512, 2N6513 2N6514	t_s			4 5	0.8 1	– –	3 3	5 5	– –	3 –	5 –	
Fall Time: 2N6512, 2N6513 2N6514	t_f			4 5	0.8 1	– –	0.5 0.5	1.5 1.5	– –	0.5 –	1.5 –	
* Thermal Resistance: Junction-to-Case	$R_{\theta JC}$	20		5		–	–	1.46	–	–	1.46	°C/W

* Minimum and maximum values and test conditions in accordance with JEDEC registration data format JC-25 RDF-1.

[a] Pulsed; pulse duration = 300 µs, duty factor ⩽ 2%.

[b] CAUTION: The sustaining voltages V_{CEO}(sus) and V_{CER}(sus) MUST NOT be measured on a curve tracer.

[c] See Figs. 10 and 11.

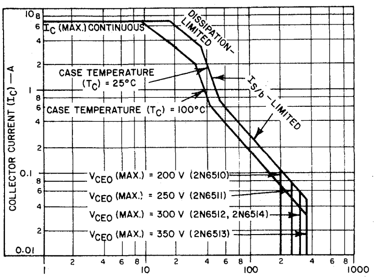


Fig. 5 - Maximum operating areas for all types at 25°C and 100°C.

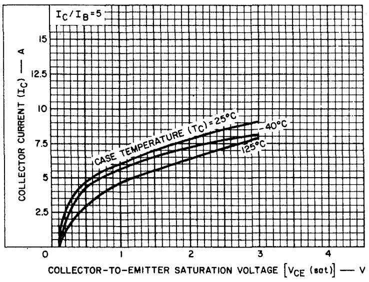


Fig. 6 - Typical collector-to-emitter saturation-voltage characteristics for all types.

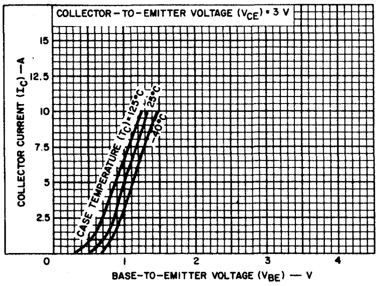


Fig. 7 - Typical transfer characteristics for all types.

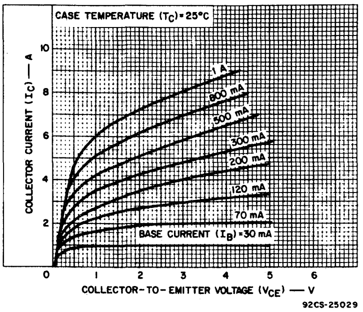


Fig. 8 - Typical output characteristics for all types.

2N6510-2N6514

ELECTRICAL CHARACTERISTICS, *Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS						UNITS
		VOLTAGE V dc		CURRENT A dc		2N6510			2N6511			
		V_{CE}	V_{BE}	I_C	I_B	Min.	Typ.	Max.	Min.	Typ.	Max.	
Collector-Cutoff Current: With base open	I_{CEO}	150 200				– –	– –	5 –	– –	– –	– 5	mA
* With base-emitter junction reverse biased	I_{CEV}	250 300	−1.5 −1.5			– –	– –	5 –	– –	– –	– 5	mA
* With base-emitter junction reverse biased, T_C = 100°C		250 300	−1.5 −1.5			– –	– –	10 –	– –	– –	– 10	
* Emitter-Cutoff Current	I_{EBO}		−6			–	–	3	–	–	3	mA
Collector-to-Emitter Sustaining Voltage: * With base open	V_{CEO}(sus)			0.2		200[b]	–	–	250[b]	–	–	V
With external base-to-emitter resistance: R_{BE} = 50 Ω	V_{CER}(sus)			0.2		250[b]	–	–	300[b]	–	–	
* Emitter-to-Base Voltage: I_E = 3 mA	V_{EBO}					6	–	–	6	–	–	V
* DC Forward-Current Transfer Ratio	h_{FE}	3 3		3[a] 4[a]		10 –	– –	50 –	– 10	– –	– 50	
* Base-to-Emitter Saturation Voltage	V_{BE}(sat)			3[a] 4[a]	0.6 0.8	– –	– –	1.7 –	– –	– –	– 1.7	V
* Collector-to-Emitter Saturation Voltage	V_{CE}(sat)			3[a] 4[a] 7[a]	0.6 0.8 3	– – –	– – 1.5	1.5 – 2.5	– – –	– – 1.5	– 1.5 2.5	V
* Output Capacitance: V_{CB} = 10 V, f = 1 MHz	C_{obo}					100	–	200	100	–	200	pF
* Magnitude of Common Emitter, Small-Signal Short-Circuit, Forward-Current Transfer Ratio: f = 1 MHz	$\|h_{fe}\|$	10		1		3	–	9	3	–	9	MHz
* Forward-Bias, Second-Breakdown Collector Current: t = 1 s, nonrepetitive	$I_{S/b}$	38 200				3.16 0.1	– –	– –	3.16 0.1	– –	– –	A
* Switching Time:[c] (V_{CC} = 200 V, I_{B1} = I_{B2}): Delay Time	t_d			3 4	0.6 0.8	– –	0.1 –	0.2 –	– –	– 0.1	– 0.2	μs
Rise Time	t_r			3 4	0.6 0.8	– –	0.7 –	1.5 –	– –	– 0.7	– 1.5	
Storage Time	t_s			3 4	0.6 0.8	– –	3 –	5 –	– –	– 3	– 5	
Fall Time	t_f			3 4	0.6 0.8	– –	0.5 –	1.5 –	– –	– 0.5	– 1.5	
* Thermal Resistance: Junction-to-Case	$R_{\theta JC}$	20		5		–	–	1.46	–	–	1.46	°C/W

* Minimum and maximum values and test conditions in accordance with JEDEC registration data format JC-25 RDF-1.

[a] Pulsed; pulse duration = 300 μs, duty factor ⩽ 2%.

[b] CAUTION: The sustaining voltages V_{CEO}(sus) and V_{CER}(sus) MUST NOT be measured on a curve tracer. These sustaining voltages should be measured by means of the test circuit shown in Fig. 11.

[c] See Figs. 8-10.

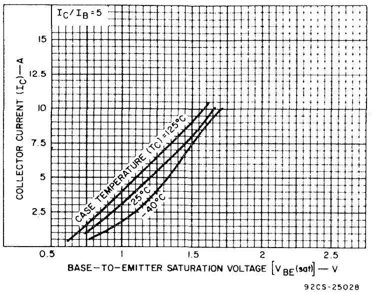


Fig. 9 - Typical base-to-emitter saturation-voltage characteristics for all types.

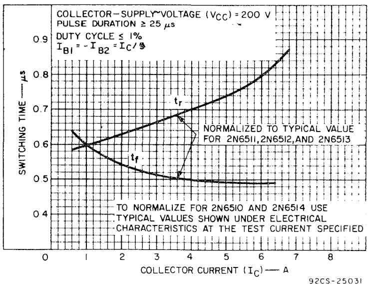


Fig. 10 - Typical rise- and fall-time characteristics for all types.

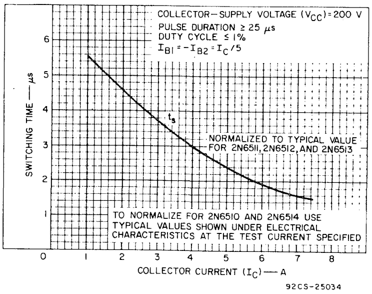


Fig. 11 - Typical storage-time characteristic for all types.

2N6530-2N6533

8-Ampere N-P-N Darlington Power Transistors

80, 100, 120 Volts, 60 Watts
Gain of 1000 at 5 A (2N6530, 2N6532)
Gain of 1000 at 3 A (2N6533)
Gain of 500 at 3 A (2N6531)

The RCA-2N6530, 2N6531, 2N6532, and 2N6533● are monolithic n-p-n silicon Darlington transistors designed for power applications at low and medium frequencies. The double epitaxial construction of these devices provides good forward and reverse second-breakdown characteristics. Their high gain allows them to be driven directly from integrated circuits.

● Formerly RCA Dev. Nos. TA8904C, TA8904D, TA8904B, and TA8904A, respectively.

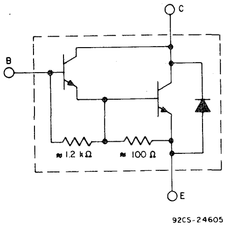
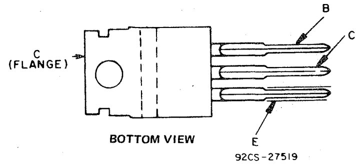


Fig. 1 - Schematic diagram for all types.

Features:
- **Operate from IC without predriver**
- **Low leakage at high temperature**
- **High reverse second-breakdown capability**

Applications:
- **Power switching**
- **Hammer drivers**
- **Series and shunt regulators**
- **Audio amplifiers**

TERMINAL DESIGNATIONS



JEDEC TO-220AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	2N6530	2N6531	2N6532	2N6533	
$^*V_{CBO}$	80	100	100	120	V
$V_{CER}(sus)$					
$R_{BE} = 100\ \Omega$	80	100	100	120	V
$V_{CEO}(sus)$	80	100	100	120	V
$^*V_{CEV}(sus)$					
$V_{BE} = -1.5$ V	80	100	100	120	V
$^*V_{EBO}$	5	5	5	5	V
$^*I_C$	8	8	8	8	A
I_{CM}	15	15	15	15	A
$^*I_B$	0.25	0.25	0.25	0.25	A
$^*P_T$					
Up to 25°C	65	65	65	65	W
Above 25°C	See Fig. 2				
$^*T_J, T_{stg}$	−65 to +150				°C
$^*T_L$					
At distances ≥ 1/8 in. (3.17 mm) from case for 10 s max.	235				°C

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* *In accordance with JEDEC registration data format JS-6, RDF-4.*

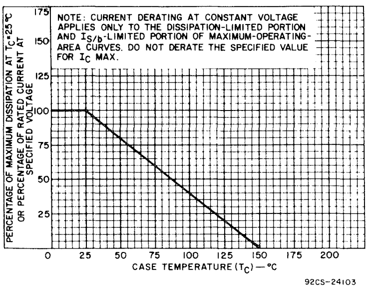


Fig. 2 - Dissipation derating curve for all types.

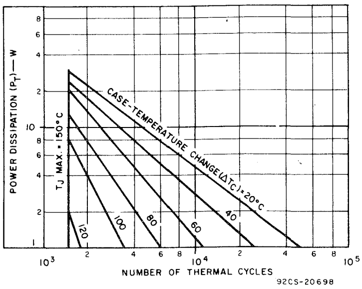


Fig. 3 - Thermal-cycling rating chart for all types.

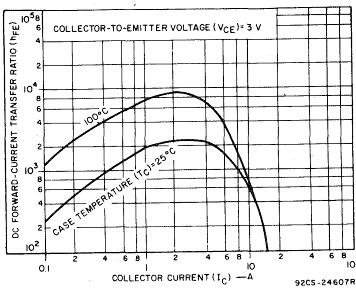


Fig. 4 - Typical dc beta characteristics for all types.

2N6530-2N6533

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC SYMBOL	TEST CONDITIONS				LIMITS				UNITS
	VOLTAGE V dc		CURRENT A dc		2N6530		2N6531		
	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
I_{CEO}	80 100			0 0	– –	1 –	– –	– 1	mA
* I_{CEV}	80 100	–1.5 –1.5			– –	0.5 –	– –	– 0.5	
* T_C = 125°C	80 100	–1.5 –1.5			– –	5 –	– –	– 5	
I_{EBO}		–5	0		–	5	–	5	mA
* h_{FE}	3 3 3		5^a 3^a 8^a		1,000 – 100	10,000 – 5,000	– 500 100	– 10,000 5,000	
V_{CEO}(sus)			0.2	0	80^b	–	100^b	–	V
V_{CER}(sus) R_{BE} = 100 Ω			0.2		80^b	–	100^b	–	
* V_{CEV}(sus)		–1.5	0.2		80^b	–	100^b	–	
V_{BE}	3 3 3		5^a 3^a 8^a		– – –	2.8 – 4.5*	– – –	– 2.8 4.5*	V
V_{CE}(sat)			3^a 5^a 8^a	0.006 0.01 0.08	– – –	– 2 3*	– – –	3 – 3*	V
V_F			5^a 8^a		– –	– 5	– –	4 –	V
h_{fe} f = 1 kHz	5		1		1,000	–	1,000	–	
* $\|h_{fe}\|$ f = 1 MHz	5		1		20	–	20	–	
C_{obo} V_{CB} = 10 V f = 1 MHz					–	200	–	200	pF
* $I_{S/b}$ t = 0.5 s, nonrep.	24				2.7	–	2.7	–	A
$E_{S/b}$ L = 12 mH R_{BE} = 100 Ω		–1.5	4.5		120	–	120	–	mJ
$R_{\theta JC}$					–	1.92	–	1.92	°C/W

* In accordance with JEDEC registration data format JS-6, RDF-4.

[a] Pulsed, pulse duration = 300 μs, duty factor ⩽ 2%.

[b] *CAUTION:* Sustaining voltages V_{CEO}(sus), V_{CER}(sus), and V_{CEV}(sus) *MUST NOT* be measured on a curve tracer.

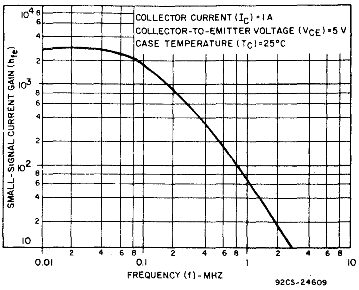


Fig. 5 - Typical small-signal current gain for all types.

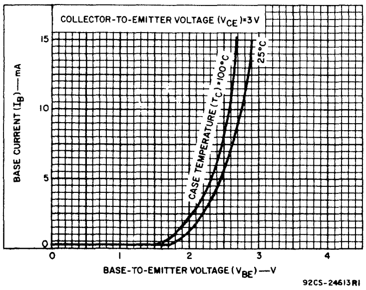


Fig. 6 - Typical input characteristics for all types.

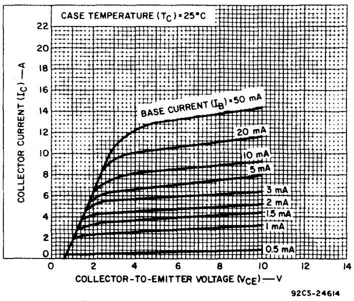


Fig. 7 - Typical output characteristics for all types.

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC SYMBOL	TEST CONDITIONS				LIMITS				UNITS
	VOLTAGE V dc		CURRENT A dc		2N6532		2N6533		
	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
I_{CEO}	120 100			0 0	– –	– 1	– –	1 –	mA
* I_{CEV}	120 100	−1.5 −1.5			– –	– 0.5	– –	0.5 –	
* T_C = 125°C	120 100	−1.5 −1.5			– –	– 5	– –	5 –	
I_{EBO}		−5	0		–	5	–	5	mA
* h_{FE}	3 3 3		3^a 5^a 8^a		– 1,000 100	– 10,000 5,000	1,000 – 100	10,000 – 5,000	
V_{CEO}(sus)			0.2	0	100^b	–	120^b	–	V
V_{CER}(sus) R_{BE} = 100 Ω			0.2		100^b	–	120^b	–	
* V_{CEV}(sus)		−1.5	0.2		100^b	–	120^b	–	
V_{BE}	3 3 3		3^a 5^a 8^a		– – –	– 2.8 4.5*	– – –	2.8 – 4.5*	V
V_{CE}(sat)			3^a 5^a 8^a	0.006 0.01 0.08	– – –	– 2 3*	– – –	2 – 3*	V
V_F			5^a 8^a		– –	– 5	– –	4 –	V
h_{fe} f = 1 kHz	5		1		1,000	–	1,000	–	
* $\|h_{fe}\|$ f = 1 MHz	5		1		20	–	20	–	
C_{obo} V_{CB} = 10 V f = 1 MHz					–	200	–	200	pF
* $I_{S/b}$ t = 0.5 s, nonrep.	24				2.7	–	2.7	–	A
$E_{S/b}$ L = 12 mH R_{BE} = 100 Ω		−1.5	4.5		120	–	120	–	mJ
$R_{\theta JC}$					–	1.92	–	1.92	°C/W

* In accordance with JEDEC registration data format JS-6, RDF-4.

[a] Pulsed, pulse duration = 300 μs, duty factor ⩽ 2%.

[b] *CAUTION:* Sustaining voltages V_{CEO}(sus), V_{CER}(sus), and V_{CEV}(sus) *MUST NOT* be measured on a curve tracer.

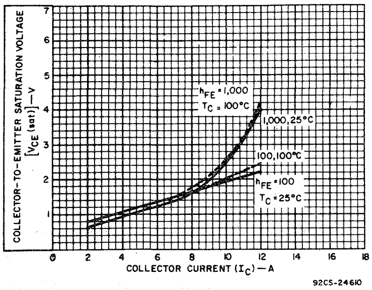


Fig. 8 - Typical saturation characteristics for all types.

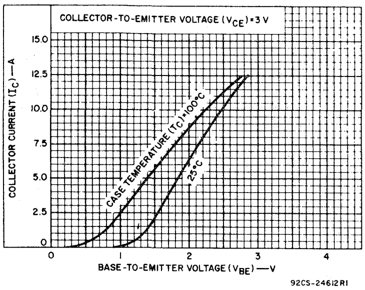


Fig. 9 - Typical transfer characteristics for all types.

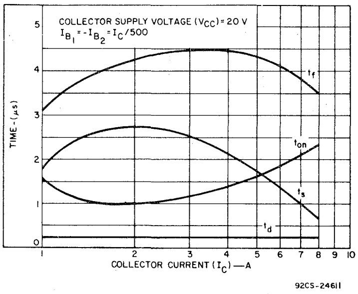


Fig. 10 - Typical saturated switching-time characteristics for all types.

2N6530-2N6533

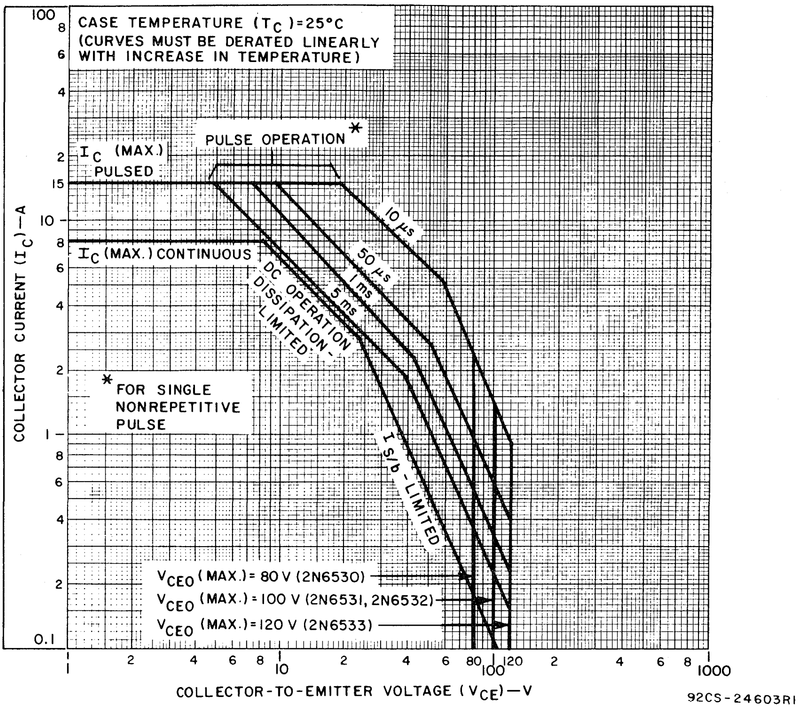


Fig. 11 - Maximum operating areas for all types at case temperature of 25°C.

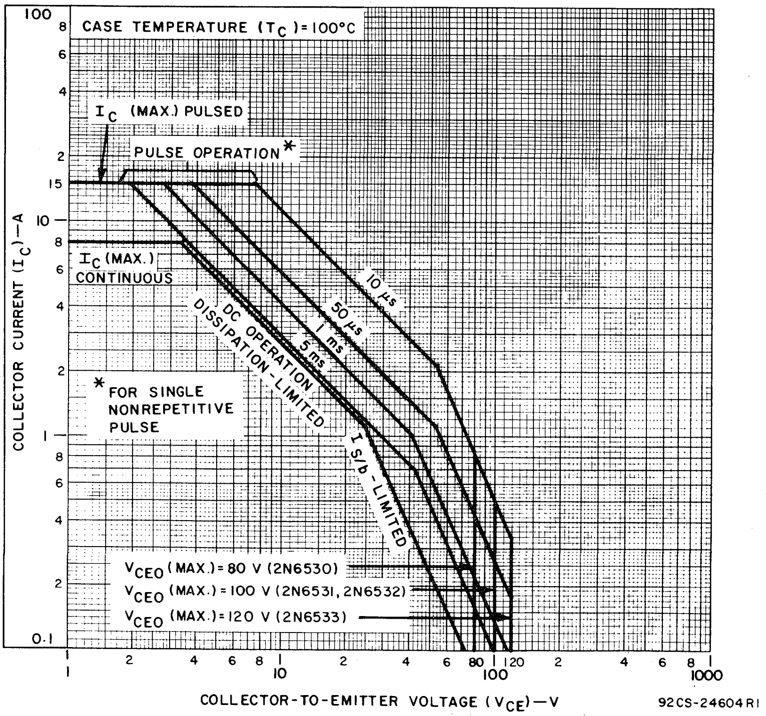


Fig. 12 - Maximum operating areas for all types at case temperature of 100°C.

2N6534-2N6537

8-Ampere N-P-N Darlington Power Transistors

80, 100, 120 Volts, 36 Watts
Gain of 1000 at 5 A (2N6534, 2N6536)
Gain of 1000 at 3 A (2N6537)
Gain of 500 at 3 A (2N6535)

The RCA-2N6534, 2N6535, 2N6536, and 2N6537● are monolithic n-p-n silicon Darlington transistors designed for power applications at low and medium frequencies. The double epitaxial construction of these devices provides good forward and reverse second-breakdown characteristics. Their high gain allows them to be driven directly from integrated circuits.

These transistors are supplied in JEDEC TO-66 hermetic packages.

● Formerly RCA Dev. Nos. TA8941C, TA8941D, TA8941B, and TA8941A, respectively.

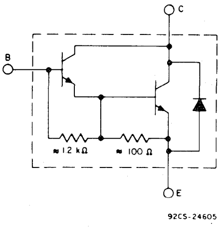


Fig. 1 - Schematic diagram for all types.

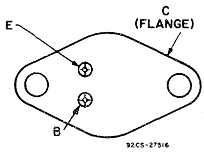
Features:

- Operate from IC without predriver
- Low leakage at high temperature
- High reverse second-breakdown capability

Applications:

- Power switching
- Audio amplifiers
- Hammer drivers
- Series and shunt regulators

TERMINAL DESIGNATIONS



JEDEC TO-66

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	2N6534	2N6535	2N6536	2N6537	
*V_{CBO}	80	100	100	120	V
V_{CER}(sus) R_{BE} = 100 Ω	80	100	100	120	V
V_{CEO}(sus)	80	100	100	120	V
*V_{CEV}(sus) V_{BE} = −1.5 V	80	100	100	120	V
*V_{EBO}	5	5	5	5	V
*I_C	8	8	8	8	A
I_{CM}	15	15	15	15	A
*I_B	0.25	0.25	0.25	0.25	A
*P_T Up to 25°C	36	36	36	36	W
Above 25°C	See Fig. 2				
*T_{stg}	−65 to +200				°C
*T_J	−65 to +150				°C
*T_L At distances ≥ 1/8 in. (3.17 mm) from case for 10 s max.	235				°C

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* In accordance with JEDEC registration data format JS-6, RDF-4.

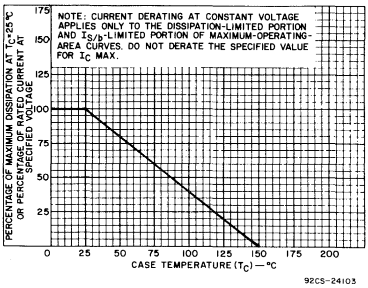


Fig. 2 - Dissipation derating curve for all types.

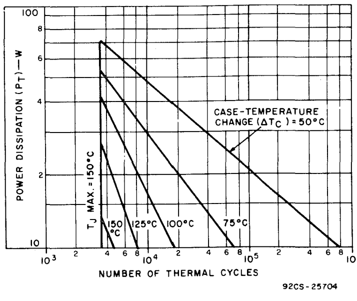


Fig. 3 - Thermal-cycling rating chart for all types.

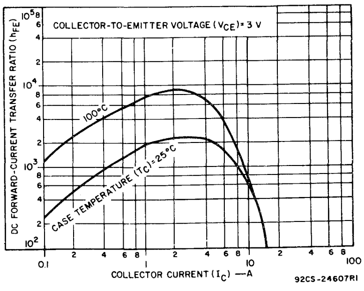


Fig. 4 - Typical dc beta characteristics for all types.

2N6534-2N6537

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC SYMBOL	TEST CONDITIONS				LIMITS				UNITS
	VOLTAGE V dc		CURRENT A dc		2N6534		2N6535		
	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
I_{CEO}	80 100			0 0	– –	1 –	– –	– 1	mA
* I_{CEV}	80 100	−1.5 −1.5			– –	0.5 –	– –	– 0.5	
* T_C = 150°C	80 100	−1.5 −1.5			– –	5 –	– –	– 5	
I_{EBO}		−5	0		–	5	–	5	mA
* h_{FE}	3 3 3		5[a] 3[a] 8[a]		1,000 – 100	10,000 – 5,000	– 500 100	– 10,000 5,000	
V_{CEO}(sus)			0.2	0	80[b]	–	100[b]	–	V
V_{CER}(sus) R_{BE} = 100 Ω			0.2		80[b]	–	100[b]	–	
* V_{CEV}(sus)		−1.5	0.2		80[b]	–	100[b]	–	
V_{BE}	3 3 3		5[a] 3[a] 8[a]		– – –	2.8 – 4.5*	– – –	– 2.8 4.5*	V
V_{CE}(sat)			3[a] 5[a] 8[a]	0.006 0.01 0.08	– – –	– 2 3*	– – –	3 – 3*	V
V_F			5[a] 8[a]		– –	– 5	– –	4 –	V
h_{fe} f = 1 kHz	5		1		1,000	–	1,000	–	
* $\|h'_{fe}\|$ f = 1 MHz	5		1		20	–	20	–	
C_{obo} V_{CB} = 10 V f = 1 MHz					–	200	–	200	pF
* $I_{S/b}$ t = 1 s, nonrep.	34				1.06	–	1.06	–	A
$E_{S/b}$ L = 12 mH R_{BE} = 100 Ω		−1.5	4.5		120	–	120	–	mJ
$R_{\theta JC}$					–	3.5	–	3.5	°C/W

* In accordance with JEDEC registration data format JS-6, RDF-4.

[a] Pulsed, pulse duration = 300 μs, duty factor ⩽ 2%.

[b] *CAUTION:* Sustaining voltages V_{CEO}(sus), V_{CER}(sus), and V_{CEV}(sus) ***MUST NOT*** be measured on a curve tracer.

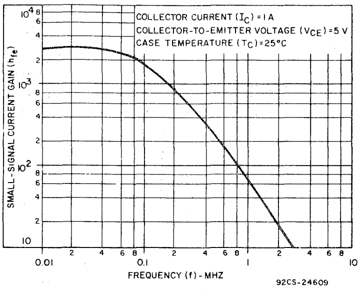


Fig. 5 - Typical small-signal current gain for all types.

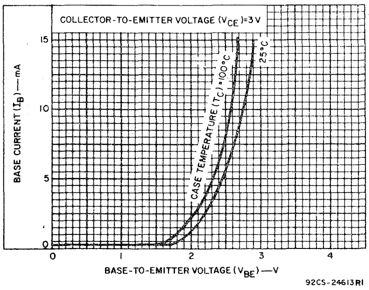


Fig. 6 - Typical input characteristics for all types.

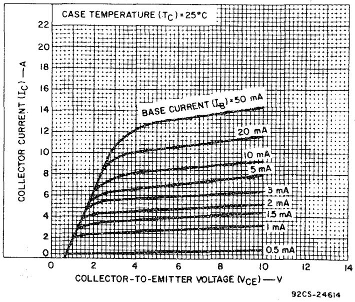


Fig. 7 - Typical output characteristics for all types.

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC SYMBOL	TEST CONDITIONS				LIMITS				UNITS
	VOLTAGE V dc		CURRENT A dc		2N6536		2N6537		
	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
I_{CEO}	120			0	–	–	–	1	mA
	100			0	–	1	–	–	
* I_{CEV}	120	−1.5			–	–	–	0.5	
	100	−1.5			–	0.5	–	–	
* T_C = 150°C	120	−1.5			–	–	–	5	
	100	−1.5			–	5	–	–	
I_{EBO}		−5	0		–	5	–	5	mA
* h_{FE}	3		3^a		–	–	1,000	10,000	
	3		5^a		1,000	10,000	–	–	
	3		8^a		100	5,000	100	5,000	
$V_{CEO}(sus)$			0.2	0	100^b	–	120^b	–	V
$V_{CER}(sus)$ R_{BE} = 100 Ω			0.2		100^b	–	120^b	–	
* $V_{CEV}(sus)$		−1.5	0.2		100^b	–	120^b	–	
V_{BE}	3		3^a		–	–	–	2.8	V
	3		5^a		–	2.8	–	–	
	3		8^a		–	4.5*	–	4.5*	
$V_{CE}(sat)$			3^a	0.006	–	–	–	2	V
			5^a	0.01	–	2	–	–	
			8^a	0.08	–	3*	–	3*	
V_F			5^a		–	–	–	4	V
			8^a		–	5	–	–	
h_{fe} f = 1 kHz	5		1		1,000	–	1,000	–	
* $\lvert h_{fe} \rvert$ f = 1 MHz	5		1		20	–	20	–	
C_{obo} V_{CB} = 10 V f = 1 MHz					–	200	–	200	pF
* $I_{S/b}$ t = 1 s, nonrep.	34				1.06	–	1.06	–	A
$E_{S/b}$ L = 12 mH R_{BE} = 100 Ω		−1.5	4.5		120	–	120	–	mJ
$R_{\theta JC}$					–	3.5	–	3.5	°C/W

* In accordance with JEDEC registration data format JS-6, RDF-4.

[a] Pulsed, pulse duration = 300 μs, duty factor ⩽ 2%.

[b] *CAUTION:* Sustaining voltages $V_{CEO}(sus)$, $V_{CER}(sus)$, and $V_{CEV}(sus)$ *MUST NOT* be measured on a curve tracer.

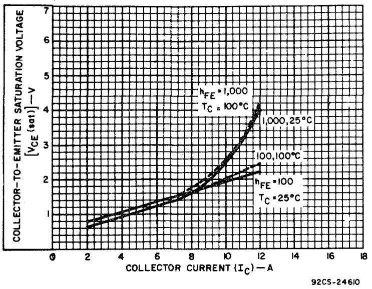


Fig. 8 - Typical saturation characteristics for all types.

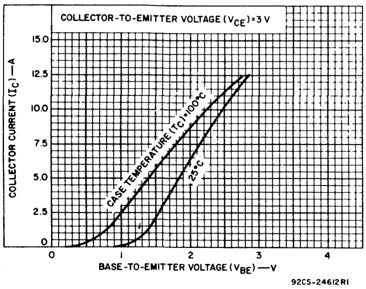


Fig. 9 - Typical transfer characteristics for all types.

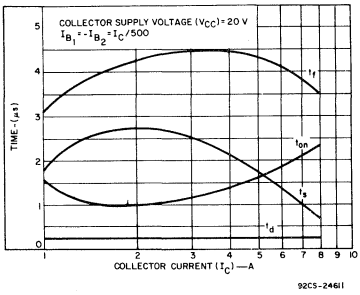


Fig. 10 - Typical saturated switching-time characteristics for all types.

2N6534-2N6537

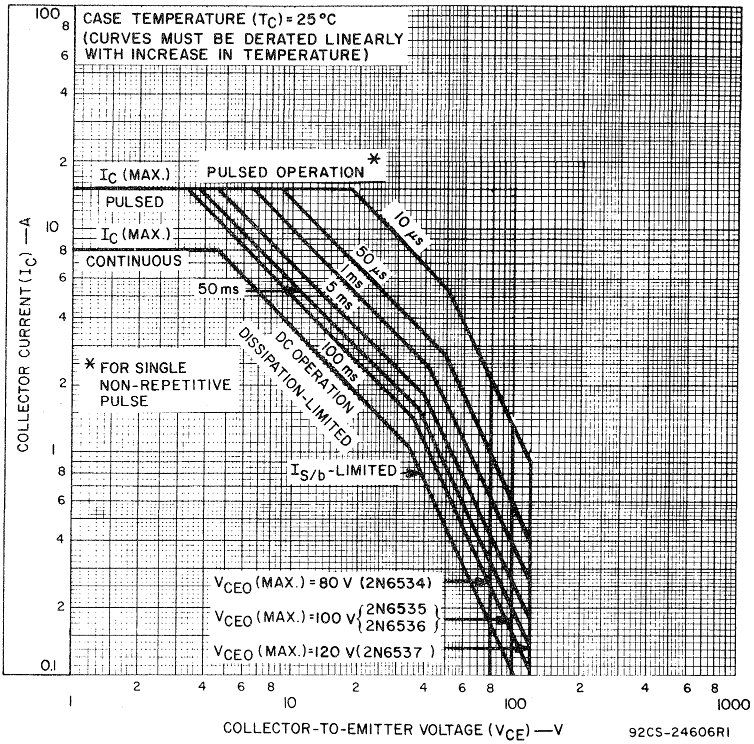


Fig. 11 - Maximum operating areas for all types at case temperature of 25°C.

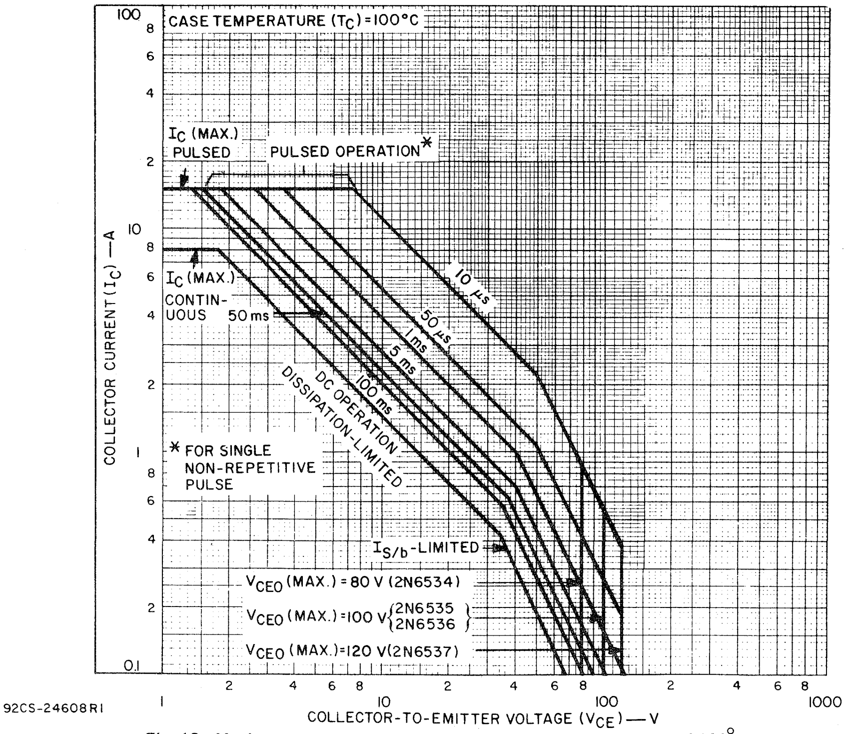


Fig. 12 - Maximum operating areas for all types at case temperature of 100°C.

2N6648, 2N6649, 2N6650

10-Ampere P-N-P Darlington Power Transistors

40-60-80 Volts, 70 Watts
Gain of 1000 at 5 A

Features:

- Operates from IC without predriver
- High reverse second-breakdown capability

Applications:

- Power switching ■ Audio amplifiers
- Hammer drivers
- Series and shunt regulators

The 2N6648, 2N6649, and 2N6650 are monolithic silicon p-n-p Darlington transistors designed for low- and medium-frequency power applications. The high gain of these devices makes it possible for them to be driven directly from integrated circuits. They are complementary to the 2N6383, 2N6384, and 2N6385.

The 2N6648, 2N6649, and 2N6650 are supplied in hermetic steel JEDEC TO-204MA packages.

The 2N6648, 2N6649, and 2N6650 are supplied in hermetic steel JEDEC TO-204MA packages.

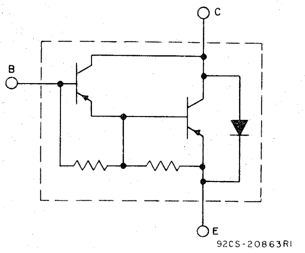
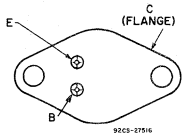


Fig. 1 — Schematic diagram for all types.

TERMINAL DESIGNATIONS



JEDEC TO-204MA/TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	2N6648	2N6649	2N6650	
* V_{CBO}	−40	−60	−80	V
V_{CER}(sus) R_{BE} = 100 Ω	−40	−60	−80	V
* V_{CEO}(sus)	−40	−60	−80	V
V_{CEV}(sus) V_{BE} = −1.5 V	−40	−60	−80	V
* V_{EBO}	−5	−5	−5	V
* I_C	−10	−10	−10	A
I_{CM}	−15	−15	−15	A
* I_B	−0.25	−0.25	−0.25	A
* P_T				
$T_C \leqslant 25°C$	70	70	70	W
$T_C > 25°C$ . . . Derate linearly		0.56		W/°C
* T_{stg}, T_J		−65 to +150		°C
* T_L At distances ⩾ 1/32 in. (0.8 mm) from seating plane for 10 s max.		235		°C

* In accordance with JEDEC registration data format (JS-6 RDF-4)

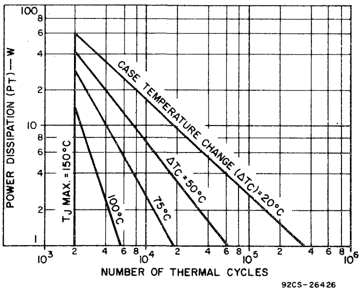


Fig. 2 — Thermal-cycling rating chart for all types.

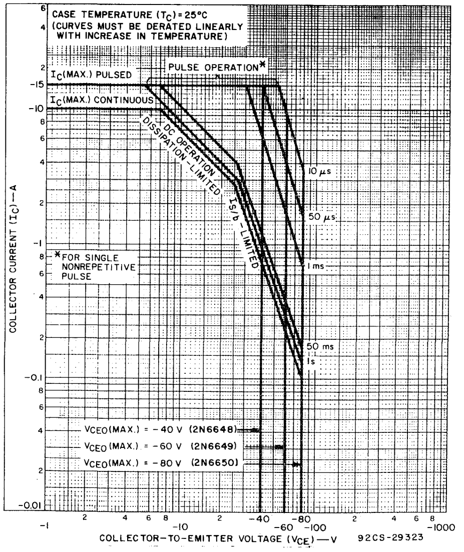


Fig. 3 — Maximum operating areas for all types.

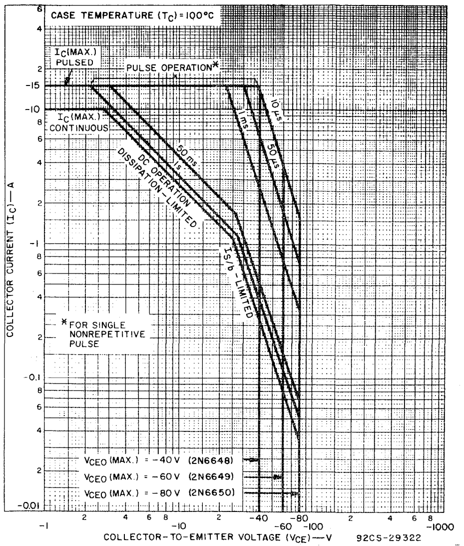


Fig. 4 — Maximum operating areas for all types at T_C = 100°C.

● Formerly RCA Dev. Nos. TA8351, TA8488, and TA8350, respectively.

2N6648, 2N6649, 2N6650

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25^{o}C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS				LIMITS						UNITS
	VOLTAGE V dc		CURRENT A dc		2N6648		2N6649		2N6650		
	V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
I_{CEO}	−40 −60 −80			0 0 0	– – –	−1 – –	– – –	– −1 –	– – –	– – −1	mA
* I_{CEV}	−40 −60 −80	1.5 1.5 1.5			– – –	−0.3 – –	– – –	– −0.3 –	– – –	– – −0.3	
T_C = 150^{o}C	−40 −60 −80	1.5 1.5 1.5			– – –	−3 – –	– – –	– −3 –	– – –	– – −3	
* I_{EBO}		5	0		–	−10	–	−10	–	−10	mA
* V_{CEO}(sus)			-0.2^a	0	−40	–	−60	–	−80	–	
V_{CER}(sus) R_{BE} = 100 Ω			-0.2^a		−40	–	−60	–	−80	–	V
V_{CEV}(sus)		1.5	-0.2^a		−40	–	−60	–	−80	–	
* h_{FE}	−3 −3		-5^a -10^a		1000 100	20,000 –	1000 100	20,000 –	1000 100	20,000 –	
V_{BE}	−3 −3		-5^a -10^a		– –	−2.8 −4.5*	– –	−2.8 −4.5*	– –	−2.8 −4.5*	V
V_{CE}(sat)			-5^a -10^a	-0.01^a -0.1^a	– –	−2 −3*	– –	−2 −3*	– –	−2 −3*	V
V_F			10^a		–	4	–	4	–	4	V
h_{fe} f = 1 kHz	−5		−1		1000	–	1000	–	1000	–	
* $\|h_{fe}\|$ f = 1 MHz	−5		−1		20	–	20	–	20	–	
$E_{S/b}$ L = 3 mH, R_{BE} = 100 Ω		1.5	−4.5		30	–	30	–	30	–	mJ
$I_{S/b}$ t = 1 s, nonrep.	−35 −25				−1 −2.8	– –	−1 −2.8	– –	−1 −2.8	– –	A
$R_{\theta JC}$					–	1.75	–	1.75	–	1.75	^{o}C/W

* In accordance with JEDEC registration data format (JS-6 RDF-4).

a Pulsed: Pulse duration = 300 μs, duty factor = 1.8%.

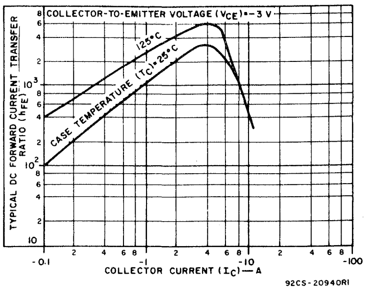


Fig. 5 – Typical dc beta characteristics for for all types.

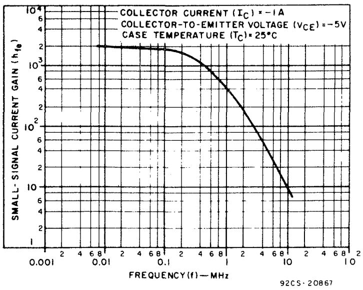


Fig. 6 – Typical small-signal gain for all types

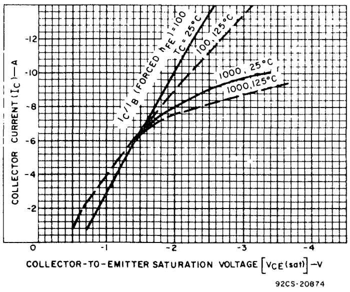


Fig. 7 – Typical saturation characteristics for all types.

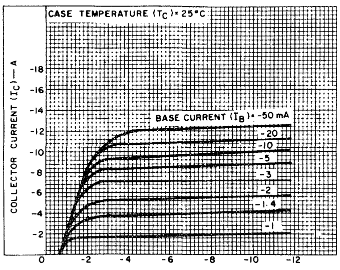


Fig. 8 – Typical output characteristics for all types.

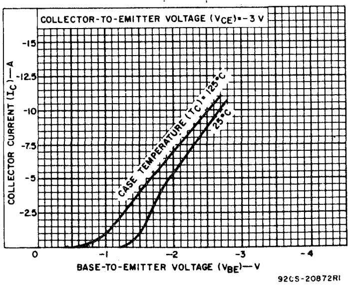


Fig. 9 – Typical transfer characteristics for all types.

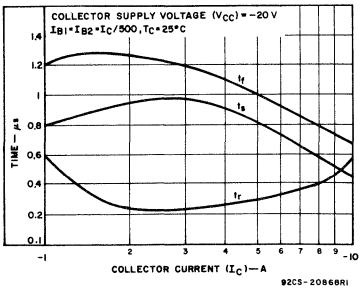


Fig. 10 – Typical saturated switching-time characteristics for all types.

40310-40314, 40316-40319, 40321-40325, 40327, 40362, 40363, 40537-40539

Silicon Transistors for Audio-Frequency Linear-Amplifier Applications

These RCA transistors are diffused-junction silicon n-p-n and p-n-p types intended for specific applications in audio amplifiers. They provide high-quality economical performance in applications from low-level input stages to driver and power-output stages of 5 to 50 watts. Supply voltages range from the nominal 12-volt vehicular type to 117-volt ac-dc type.

The use of all-silicon devices permits more flexibility in the mechanical and electrical design of amplifiers since the output heat sinks can be held to a minimum.

Features:

- **Hermetically-sealed packages**
- **Operation at case temperatures up to 257°F**
- **Pellet bonded to header —**
  - **for greater power-handling capability**
  - **for greater shock resistance**
- **Freedom from second breakdown**
- **40319 and 40538 are p-n-p complements of 40317 and 40539, respectively**

N-P-N TYPES IN TO-66 PACKAGE

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	40310	40312	40313	40316	40318	40322	40324	
V_{CEO}(sus)	35	60	–	–	–	–	35	V
V_{CER}(sus)	–	–	300	40	300	300	–	V
At R_{BE}	–	–	500	500	500	500	–	Ω
V_{EBO}	2.5	2.5	2.5	5	6	6	2.5	V
I_C	4	4	2	4	2	2	4	A
I_B	2	2	1	2	1	1	2	A
P_T:								
$T_C \leqslant 25^oC$	29	29	35	29	35	35	29	W
$T_C > 25^oC$, derate linearly	0.17	0.17	0.2	0.17	0.2	0.2	0.17	W/°C
$T_C = 175^oC$	–	–	5	–	5	5	–	W
T_{stg}, T_J	–65 to 200							°C
T_L (During soldering): At distances ⩾ 1/16 in.(1.58 mm) from case for 10 s max.	235							°C

N-P-N TYPES IN TO-39 PACKAGE

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	40311	40314	40317	40321	40323	40327	40539	
V_{CEO}(sus)	30	40	40	–	18	–	–	V
V_{CER}(sus)	–	–	–	300	–	300	55	V
At R_{BE}	–	–	–	500	–	1000	500	Ω
V_{EBO}	2.5	2.5	2.5	5	2.5	5	5	V
I_C	0.7	0.7	0.7	1	0.7	1	0.7	A
I_B	0.2	0.2	0.2	0.5	0.2	0.5	–	A
P_T:								
$T_C \leqslant 25^oC$	5	5	5	5	5	5	5	W
$T_C > 25^oC$,derate linearly	0.029							W/°C
$T_A \leqslant 25^oC$	1	1	1	1	1	1	1	W
T_{stg}, T_J	–65 to 200							°C
T_L (During soldering): At distances ⩾ 1/16 in.(1.58 mm) from case for 10 s max.	300	300	300	255	300	255	255	°C

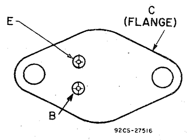
P-N-P TYPES IN TO-39 PACKAGE

N-P-N TYPES IN TO-3 PACKAGE

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	P-N-P TYPES IN TO-39 PACKAGE				N-P-N TYPES IN TO-3 PACKAGE		
	40319	40362	40537	40538	40325	40363	
V_{CBO}	–	–	–	–	35	–	V
V_{CEO}(sus)	–40	–	–	–	35	–	V
V_{CER}(sus)	–	–70	–55	–55	–	70	V
At R_{BE}	–	200	500	500	–	200	Ω
V_{CEV}(sus)							
At $V_{BE} = -1.5$ V	–	–	–	–	35	–	V
V_{EBO}	–2.5	–4	–5	–5	5	4	V
I_C	–0.7	–0.7	–0.7	–0.7	15	15	A
I_B	–0.2	–0.2	–0.2	–0.2	7	7	A
P_T:							
$T_C \leqslant 25^oC$	5	5	5	5	117	115	W
$T_C > 25^oC$, derate linearly	0.029	0.029	0.029	0.029	0.67	0.66	W/°C
$T_A \leqslant 25^oC$	1	1	1	1	–	–	W
T_{stg}, T_J	–65 to 200				–65 to 200		°C
T_L (During soldering): At distances ⩾ 1/16 in.(1.58 mm) from case for 10 s max.	230				235		°C

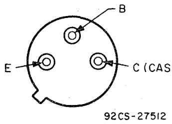
TERMINAL DESIGNATIONS



JEDEC TO-3

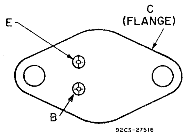
n-p-n

40325
40363



JEDEC TO-39

n-p-n	**p-n-p**
40311	40319
40314	40362
40317	40537
40321	40538
40323	
40327	
40539	



JEDEC TO-66

n-p-n

40310	40316
40312	40318
40313	40322
40324	

40310-40314, 40316-40319, 40321-40325, 40327, 40362, 40363, 40537-40539

Types: 40321, 40323, 40327, n-p-n
Package: JEDEC TO-39
ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C)= 25°C Unless Otherwise Specified*

CHARAC-TERISTIC	TEST CONDITIONS	LIMITS						UNITS
		40321		40323		40327		
		Min.	Max.	Min.	Max.	Min.	Max.	
I_{CBO}	V_{CB}=15 V,I_E=0,T_C=25°C	–	–	–	0.25	–	–	µA
	V_{CB}=150 V,I_E=0,T_C=150°C	–	0.1	–	1	–	0.1	mA
I_{CER}	V_{CE}=150 V,R_{BE}=1000 Ω	–	5	–	–	–	5	µA
I_{EBO}	V_{BE}=–2.5 V (40323)	–	–	–	1	–	–	mA
	V_{BE}=–5 V (40321,40327)	–	0.1	–	–	–	0.1	
V_{CEO}(sus)	I_C=100 mA*	–	–	18	–	–	–	V
V_{CER}(sus)	I_C=50 mA*,R_{BE}=1000 Ω	300	–	–	–	300	–	V
V_{BE}	V_{CB}=4 V,I_C=50 mA*(40323)	–	–	–	1	–	–	V
	V_{CB}=10 V,I_C=50 mA* (40321,40327)	–	2	–	–	–	2	
h_{FE}	V_{CE}=4 V,I_C=50 mA*(40323)	–	–	70	350	–	–	
	V_{CE}=10 V,I_C=20 mA* (40321,40327)	25	200	–	–	40	250	
f_T	V_{CE}=10 V,I_C=50 mA	–	–	100 typ.		–	–	MHz
$R_{\theta JC}$		–	35	–	35	–	30	°C/W
$R_{\theta JA}$		–	–	–	175	–	–	

* Pulsed: Pulse duration = 300 µs, duty factor ⩽ 2%.

For characteristics curves and test conditions, refer to published data for prototype per chart on page 223.

Types: 40311, 40314, 40317, n-p-n 40319, p-n-p
Package: JEDEC TO-39
ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARAC-TERISTIC	TEST CONDITIONS▲	LIMITS						UNITS
		40311		40314		40317 40319▲		
		Min.	Max.	Min.	Max.	Min.	Max.	
I_{CBO}	V_{CB}=15 V, I_E=0 T_C=25°C	–	0.25	–	0.25	–	0.25	µA
	T_C=150°C	–	1	–	1	–	1	mA
I_{EBO}	V_{BE}=–2.5 V	–	1	–	1	–	1	mA
V_{CEO}(sus)	I_C=100 mA*	30	–	40	–	40	–	V
V_{BE}	V_{CE}=4 V I_C=10 mA*(40317);I_C=50 mA (40311,40314,40319)	–	1	–	1	–	1	V
V_{CE}(sat)	I_C=150 mA*, I_B=15 mA	–	–	–	1.4	–	–1.4●	V
h_{FE}	V_{CE}=4 V I_C=10 mA*(40317);I_C=					40	200	
	50 mA*(40311,40314,40319)	70	350	70	350	35●	200●	
f_T	V_{CE}=10 V(40311);V_{CE}=4 V (40314,40319),I_C=50 mA	100 typ.		100 typ.		100 typ.●		MHz
$R_{\theta JC}$		–	35	–	35	–	35	°C/W
$R_{\theta JA}$		–	175	–	175	–	175	

▲ For p-n-p devices, voltage and current are negative.

● 40319 *Pulsed: Pulse duration = 300 µs, duty factor ⩽ 2%.

For characteristics curves and test conditions, refer to published data for prototype per chart on page 223.

40310-40314, 40316-40319, 40321-40325, 40327, 40362, 40363, 40537-40539

Types: 40362, 40537, 40538, p-n-p 40539, n-p-n
Package: JEDEC TO-39
ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARAC-TERISTIC	TEST CONDITIONS●	LIMITS						UNITS
		40362		40537		40538 40539●		
		Min.	Max.	Min.	Max.	Min.	Max.	
I_{CER}	V_{CE}=–45 V,R_{BE}=500 Ω, T_C=25°C	–	–	–	–10	–	–10	μA
	V_{CE}=–65 V,R_{BE}=1000 Ω, T_C=25°C	–	–1	–	–	–	–	
	V_{CE}=–60 V,R_{BE}=1000 Ω, T_C=150°C	–	–100	–	–	–	–	
I_{EBO}	V_{BE}=4 V	–	–1	–	–	–	–	mA
	V_{BE}=5 V	–	–	–	–1	–	–1	
V_{CER}(sus)	I_C=–100 mA*,R_{BE}=500 Ω	–	–	–55	–	–55	–	V
	I_C=–100 mA*,R_{BE}=1000 Ω	–70	–	–	–	–	–	
V_{BE}	V_{CE}=–4 V,I_C=–50 mA*	–	–1	–	–1.8	–	–	V
	V_{CE}=–4 V,I_C=–500 mA*	–	–	–	–	–	–2.7	
V_{CE}(sat)	I_C=–50 mA*,I_B=–5 mA	–	–	–	–1.1	–	–	V
	I_C=–150 mA*, I_B=–15 mA	–	–1.4	–	–	–	–	
	I_C=–500 mA*,I_B=–50 mA	–	–	–	–	–	–2	
h_{FE}	V_{CE}=–4 V,I_C=–50 mA*	35	200	50	300	–	–	
	V_{CE}=–4 V,I_C=–500 mA*	–	–	–	–	15	90	
f_T	V_{CE}=–4 V,I_C=–50 mA	100 typ.		100 typ.		100 typ.		MHz
$R_{\theta JC}$		–	35	–	–	–	35▲	°C/W
$R_{\theta JA}$		–	175	–	175	–	175	

● For n-p-n devices, voltage and current are positive.
▲ 40539 *Pulsed: Pulse duration = 300 μs, duty factor ⩽ 2%.
For characteristics curves and test conditions, refer to published data for prototype per chart on page 223.

Types: 40310, 40312, 40316, 40324, n-p-n
Package: JEDEC TO-66
ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARAC-TERISTIC	TEST CONDITIONS	LIMITS						UNITS
		40310 40312		40316		40324		
		Min.	Max.	Min.	Max.	Min.	Max.	
I_{CBO}	V_{CB}=15 V,I_E=0							
	T_C=25°C	–	10	–	10	–	10	μA
	T_C=150°C	–	5	–	5	–	5	mA
I_{EBO}	V_{BE}=–2.5 V	–	5	–	–	–	5	mA
	V_{BE}=–5 V	–	–	–	5	–	–	
V_{CEO}(sus)	I_C=100 mA*	35●	–	–	–	35	–	V
V_{CER}(sus)	I_C=100 mA*,R_{BE}=500 Ω	60#	–	40	–	–	–	V
V_{BE}	V_{CE}=2 V,I_C=1 A*	–	1.4	–	1.4	–	1.4	V
h_{FE}	V_{CE}=2 V,I_C=1 A*	20	120	20	120	20	120	
f_T	V_{CE}=4 V,I_C=500 mA	750 typ.		750 typ.		750 typ.		kHz
$R_{\theta JC}$		–	6	–	6	–	6	°C/W

● 40310 # 40312 *Pulsed: Pulse duration = 300 μs, duty factor ⩽ 2%.
For characteristics curves and test conditions, refer to published data for prototype per chart on page 223.

40310-40314, 40316-40319, 40321-40325, 40327, 40362, 40363, 40537-40539

Types: 40313, 40318, 40322, n-p-n
Package: JEDEC TO-66
ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARAC-TERISTIC	TEST CONDITIONS	LIMITS						UNITS
		40313		40318		40322		
		Min.	Max.	Min.	Max.	Min.	Max.	
I_{CEO}	V_{CE}=150 V,I_B=0	–	5	–	5	–	–	mA
I_{CEV}	V_{CE}=150 V (40318),V_{CE}= 300 V (40313), V_{BE}= −1.5 V, T_C=25°C	–	10	–	5	–	–	mA
	T_C=150°C	–	10	–	10	–	–	
I_{EBO}	V_{BE}=−2.5 V	–	5	–	–	–	–	mA
	V_{BE}=−6 V	–	–	–	5	–	5	
V_{CER}(sus)	I_C=200 mA*,R_{BE}=200 Ω, L=500 mH	300	–	300	–	300	–	V
V_{BE}	V_{CE}=10 V, I_C=100 mA*	–	1.5	–	–	–	–	V
	I_C=500 mA*	–	–	–	1.5	–	–	
h_{FE}	V_{CE}=10 V, I_C=500 mA*	40	–	50	–	75	–	
	I_C=100 mA*	40	250	–	–	–	–	
	I_C=20 mA*	–	–	40	–	40	–	
$I_{S/b}$	V_{CE}=150 V	150	–	100	–	100	–	mA
$E_{S/b}$	V_{BE}=−4 V	–	–	50	–	50	–	μJ
$R_{\theta JC}$		–	5	–	5	–	5	°C/W

*Pulsed: Pulse duration = 300 μs, duty factor ⩽ 2%.

For characteristics curves and test conditions, refer to published data for prototype per chart on page 223.

Types: 40325, 40363, n-p-n
Package: JEDEC TO-3
ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARAC-TERISTIC	TEST CONDITIONS	LIMITS				UNITS
		40325		40363		
		Min.	Max.	Min.	Max.	
I_{CBO}	V_{CB}=30 V, T_C=25°C	–	5	–	–	mA
	T_C=150°C	–	10	–	–	
I_{CER}	V_{CE}=60 V,R_{BE}=200 Ω, T_C=25°C	–	–	–	1	mA
	T_C=150°C	–	–	–	10	
I_{EBO}	V_{BE}=−5 V	–	10	–	–	mA
	V_{BE}=−4 V	–	–	–	5	
V_{CEO}(sus)	I_C=200 mA*	35	–	–	–	V
V_{CER}(sus)	I_C=200 mA*,R_{BE}=200 Ω	–	–	70	–	V
V_{CBO}	I_C=100 mA,I_E=0	35	–	–	–	V
V_{BE}	V_{CE}=4 V, I_C=8 A*	–	2	–	–	V
	I_C=4 A*	–	–	–	1.8	
V_{CE}(sat)	I_C=8 A*, I_B=800 mA	–	1.5	–	–	V
	I_C=4 A*,I_B=400 mA	–	–	–	1.1	
h_{FE}	V_{CE}=4 V, I_C=8 A*	12	60	–	–	
	I_C=4 A*	–	–	20	70	
f_T	V_{CE}=4 V,I_C=3 A	–	–	700 typ.		kHz
$R_{\theta JC}$		–	1.5	–	1.5	°C/W

*Pulsed: Pulse duration = 300 μs, duty factor ⩽ 2%.

For characteristics curves and test conditions, refer to published data for prototype per chart on page 223.

40310-40314, 40316-40319, 40321-40325, 40327, 40362, 40363, 40537-40539

PROTOTYPES FOR AUDIO TRANSISTORS

Audio Type No.	Prototype Type No.	Prototype Data Sheet No.*
40310	2N3054	527
40311	2N2102	106
40312	2N3054	537
40313	2N3585	138
40314	2N2102	106
40316	2N3054	527
40317	2N2102	106
40318	2N3585	138
40319	2N4036	216
40321	2N3439	64
40322	2N3585	138
40323	2N2102	106
40324	2N3054	527
40325	2N3055	524
40327	2N3439	64
40362	2N4036	216
40363	2N3055	524
40537	2N4036	216
40538	2N5322	325
40539	2N5320	325

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* Characteristics curves and test conditions shown in these data sheets for the prototypes are also applicable to the corresponding audio types.

40406, 40408, 40410, 40407, 40409, 40411

Silicon N-P-N and P-N-P Power Transistors

For Audio-Amplifier Applications

RCA-40406-40411, inclusive, are diffused-junction silicon n-p-n and p-n-p transistors intended for use in audio amplifiers. Giving high-quality performance economically, these six devices have power dissipation ratings of 1 to 150 W. Types 40406, 40407, and 40408 are supplied in JEDEC TO-39 hermetic packages; types 40409 and 40410 are in TO-39 packages mounted on integral heat radiators. The 40411 unit, intended for use in audio output stages, is in a steel JEDEC TO-3 hermetic package.

	40406	40407	40408	40409	40410	40411	
$V_{CEO}(sus)$	-50	50	90	–	–	–	V
$V_{CER}(sus)$ $R_{BE} = 100\ \Omega$	–	–	–	90	-90	90	V
V_{EBO}	-4	4	4	4	-4	4	V
I_C	-0.7	0.7	0.7	0.7	-0.7	30	A
I_B	-0.2	0.2	0.2	0.2	-0.2	15	A
P_T:							
$T_A \leq 25°C$	1	1	1	–	–	–	W
$T_A \leq 50°C$	–	–	–	3	3	–	W
$T_C \leq 25°C$	–	–	–	–	–	150	W
T_J	-65 to +200						°C

Features:

40406 & 40407

- **$V_{CEO}(sus)$ = -50 V max. (40406)**
- **$V_{CEO}(sus)$ = 50 V max. (40407)**
- **40406 is p-n-p complement of 40407**
- **1 W dissipation rating**

40408

- **$V_{CEO}(sus)$ = 90 V max.**
- **1 W dissipation rating**

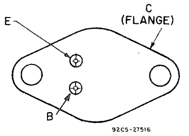
40409 & 40410

- **$V_{CER}(sus)$ = 90 V max. (40409)**
- **$V_{CER}(sus)$ = -90 V max. (40410)**
- **40410 is p-n-p complement of 40409**
- **3 W free-air dissipation rating**

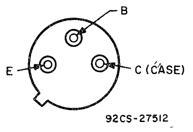
40411

- **$V_{CER}(sus)$ = 90 max.**
- **Hometaxial-base construction**
- **150 W dissipation rating**

TERMINAL DESIGNATIONS



JEDEC TO-3



JEDEC TO-39

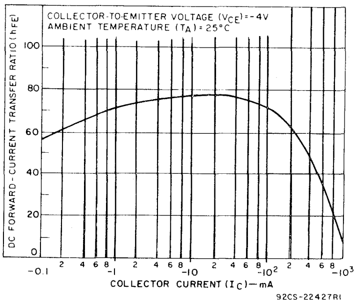


Fig. 1 – Typical dc beta characteristic for 40406 and 40410.

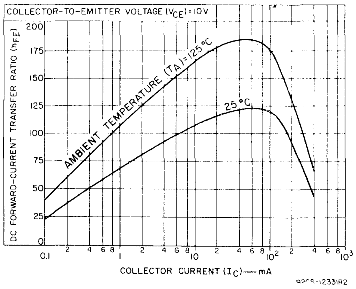


Fig. 2 – Typical dc beta characteristics for 40407, 40408, and 40409.

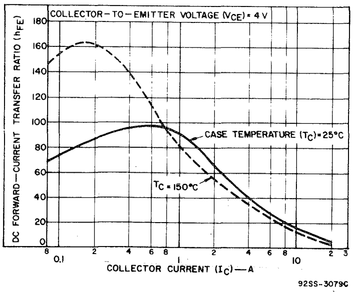


Fig. 3 – Typical dc beta characteristics for 40411.

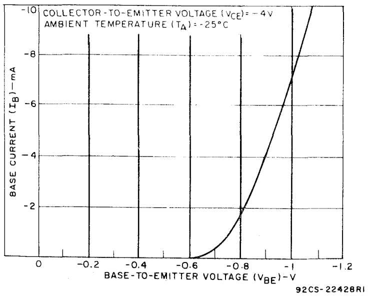


Fig. 4 – Typical input characteristic for 40406 and 40410.

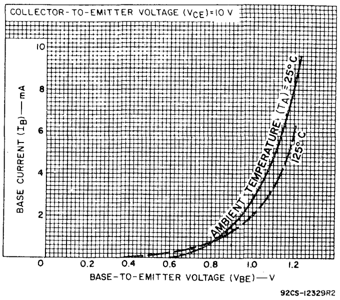


Fig. 5 – Typical input characteristics for 40407, 40408, and 40409.

40406, 40408, 40410, 40407, 40409, 40411

ELECTRICAL CHARACTERISTICS, *$T_C = 25°$ Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS			LIMITS								
	VOLTAGE V dc	CURRENT A dc		40406# 40407		40408		40409 40410#		40411		
	V_{CE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	UNITS
I_{CBO} $I_E = 0$	10•			–	0.25♠	–	–	–	–	–	–	µA
I_{CEO}	40			–	1	–	–	–	–	–	–	µA
	80			–	–	–	1	–	–	–	–	
$T_C = 150°$ C												mA
40406	40			–	0.01	–	–	–	–	–	–	
40407	40			–	0.1	–	–	–	–	–	–	
40408	80			–	–	–	0.25	–	–	–	–	
I_{CER} $R_{BE} = 100\ \Omega$	80			–	–	–	–	–	1	–	500	µA
$T_C = 150°$ C	80			–	–	–	–	–	0.1	–	2	mA
I_{EBO} $V_{BE} = -4$ V		0		–	100	–	100	–	100	–	500	µA
$V_{CEO}(sus)$		0.1[a]	0	50[b]	–	90[b]	–	–	–	–	–	V
$V_{CER}(sus)$		0.1			–	–	–		–	–	–	V
$R_{BE} = 100\ \Omega$		0.2			–	–	–	–	–	90	–	
V_{BE}	10	0.001[a]		–	0.8[c]	–	–	–	–	–	–	V
	4	0.01[a]		–	–	–	1	–	–	–	–	
	4	0.15[a]		–	–	–	–	–	1	–	–	
	4	4[a]		–	–	–	–	–	–	–	1.2	
$V_{CE}(sat)$		0.15[a]	0.015	–	–	–	1.4	–	1.4	–	–	V
		4[a]	0.4	–	–	–	–	–	–	–	0.8	
h_{FE} 40406	10	0.1 mA[a]		30	200	–	–	–	–	–	–	
40407	10	0.001[a]		40	200	–	–	–	–	–	–	
40408	4	0.01[a]		–	–	40	200	–	–	–	–	
40409-10	4	0.15[a]		–	–	–	–	50	250	–	–	
40411	4	4[a]		–	–	–	–	–	–	35	100	
h_{fe} f = 20 MHz	10	0.05		6♠	–	–	–	–	–	–	–	
f_T	4	0.05		100 (typ.)		100 (typ.)		100 (typ.)		–	–	MHz
	4	4		–	–	–	–	–	–	800 (typ.)		kHz
C_{obo} $I_E = 0$ f = 1 MHz	10•			15♠	–	–	–	–	–	–	–	pF
$I_{S/b}$ t = 1s nonrep	40			–	–	–	–	5*	–	–	–	A
$R_{\theta JC}$				–	35	–	35	–	–	–	1.17	°C/W
$R_{\theta JA}$				–	175	–	175	–	50	–	–	

\# For p-n-p devices, voltage and current values are negative

• V_{CB} ♠ 40407 only * 40410 only

[a] Pulsed; pulse duration = 300 µs, duty factor ≤ 2%

[b] CAUTION: The sustaining voltage $V_{CEO}(sus)$ MUST NOT be measured on a curve tracer. $V_{CEO}(sus)$ should be measured by the pulse method (Note 'a').

[c] 40406 tested at $I_C = -0.1$ mA

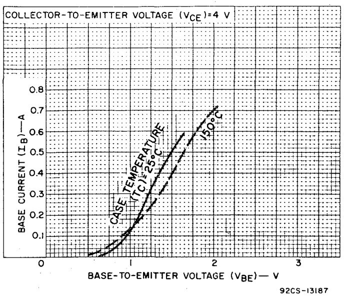


Fig. 6 – Typical input characteristics for 40411.

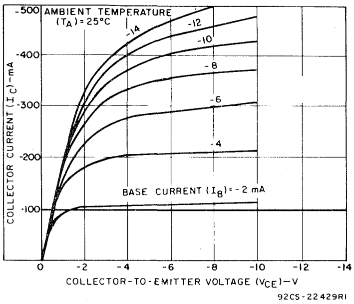


Fig. 7 – Typical output characteristics for 40406 and 40410.

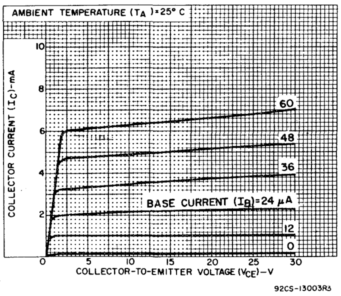


Fig. 8 – Typical output characteristics for 40407, 40408, and 40409.

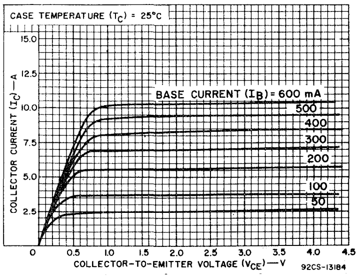


Fig. 9 – Typical output characteristics for 404II.

40631, 41504

Hometaxial-Base Silicon N-P-N VERSAWATT Transistors

Designed for Medium-Power
Linear and Switching Applications

The RCA-40631 and 41504 are hometaxial-base silicon n-p-n transistors intended for a wide variety of medium-power applications. The hometaxial-base construction of these devices renders them highly resistant to second breakdown over a wide range of operating conditions. Type 40631 is intended especially for use in driver and output stages in high-fidelity audio-amplifier circuits; the 41504 is a general-purpose device.

Both of these transistor types are supplied in the VERSAWATT flame-retardant plastic package. The 40631 is supplied in the JEDEC TO-220AA formed-lead version of this package for use with TO-66 sockets; the 41504 is supplied in the JEDEC TO-220AB, straight-lead version.

Features:

- **Low saturation voltages**
- **High dissipation ratings**

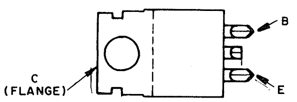
Applications:

- **Series and shunt regulators**
- **High-fidelity amplifiers**
- **Power-switching circuits**
- **Solenoid drivers**

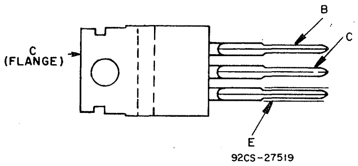
MAXIMUM RATINGS, *Absolute-Maximum Values:*

	40631	41504	
V_{CER}(sus) R_{BE} = 100 Ω	45	35	V
V_{EBO}	5	4	V
I_C	4	4	A
I_B	2	2	A
P_T:			
At $T_C \leqslant 25^oC$	36	36	W
At $T_C > 25^oC$ Derate linearly	0.288		W/°C
At $T_A \leqslant 25^oC$	1.8	–	W
T_J, T_{stg}	–65 to +150		°C
T_L At distances $\geqslant$ 1/32 in. (0.8 mm) from seating plane for 10 s max.	235		°C

TERMINAL DESIGNATIONS



JEDEC TO-220AA



JEDEC TO-220AB

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C*

CHARACTERISTIC	TEST CONDITIONS				LIMITS				UNITS
	VOLTAGE V dc		CURRENT A dc		40631		41504		
	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
I_{CER}	20				–	–	–	5	mA
R_{BE} = 100 Ω	40				–	0.5	–	–	
I_{EBO}		–4	0		–	–	–	1	mA
		–5	0		–	1	–	–	
V_{CER}(sus)			0.1^a		–	–	35	–	V
R_{BE} = 100 Ω			0.2^a		45	–	–	–	
h_{FE}	4		1^a		–	–	25	–	
	4		2^a		20	70	–	–	
V_{CE}(sat)			1^a	0.05	–	–	–	1	V
			2^a	0.2	–	1	–	–	
V_{BE}	4		1^a		–	–	–	1.5	V
	4		2^a		–	1.5	–	–	
$\vert h_{fe} \vert$ f = 0.4 MHz	4		0.2		2	–	2	–	
$R_{\theta JC}$					–	3.5	–	3.5	°C/W
$R_{\theta JA}$					–	70	–	70	

^{a} Pulsed: Pulse duration = 300 μs, duty factor $\leqslant$ 2%.

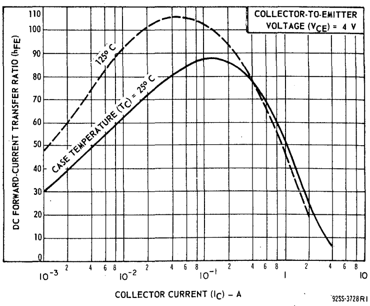


Fig. 1 – Typical dc beta characteristics for 40631.

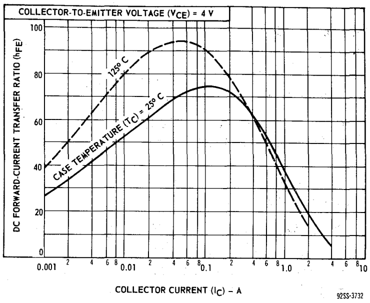


Fig. 2 – Typical dc beta characteristics for 41504.

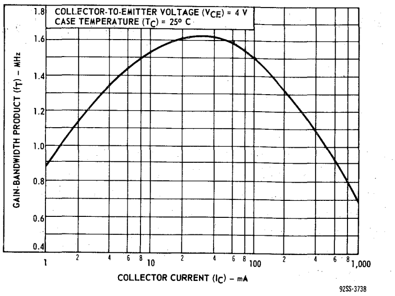


Fig. 3 – Typical gain-bandwidth product for 40631.

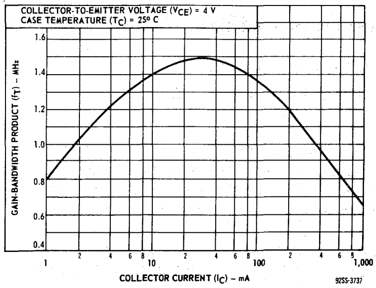


Fig. 4 – Typical gain-bandwidth product for 41504.

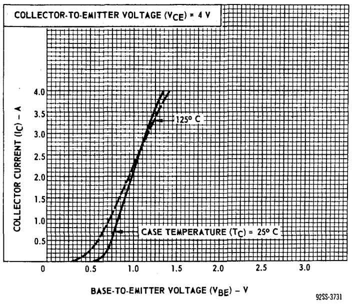


Fig. 5 – Typical transfer characteristics for 40631.

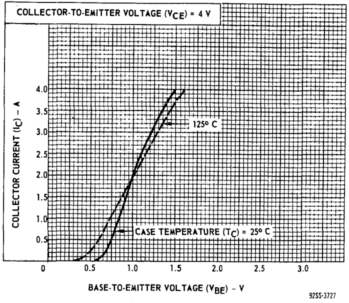


Fig. 6 – Typical transfer characteristics for 41504.

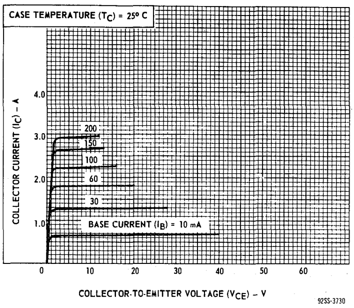


Fig. 7 – Typical output characteristics for 40631.

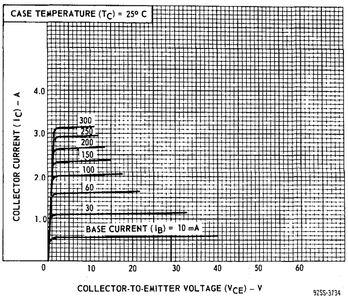


Fig. 8 – Typical otuput characteristics for 41504.

40850, 40851, 40852, 40854

450-V Silicon N-P-N Power Transistors

For Off-Line Switching-Regulator Type Power-Supply Applications

The RCA-40850, 40851, 40852, and 40854 are n-p-n types selected from RCA's line of silicon power transistors for power-supply applications. Their high-voltage ratings permit operation directly off the power line thereby eliminating the heavy and bulky 60-Hz power transformer; their fast switching speeds permit operation above the audio-frequency range (20 to 30 KHz) for quiet performance and permit the use of small ferrite-core transformers for changing voltage levels.

These devices have sufficient voltage capability to be used as push-pull inverters or pulse-width-modulated inverters operating directly off the 120-V power line; they can operate as switching regulators off a 240-V line; for 120-V lines, the prototypes can be used.

Features:

- **High-voltage ratings for operation from power lines without a step-down transformer**
- **Popular JEDEC TO-3 and TO-66 hermetic packages**

Applications:

- **For use in switching-regulator supplies which feature:**
  —A substantial reduction in size and weight due to elimination of the 60-Hz power transformer.
  —Operation with a substantial reduction of heat
- **5-V, off-line supplies with current ratings of 25, 50, 100, or 200 A**
- **30-V, off-line supplies with current ratings of 5, 10, 20, or 40 A**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	40850	40851	40852	40854	
V_{CBO}	450	450	450	450	V
$V_{CEO}(sus)$	300	350	350	300	V
$V_{CER}(sus)$ $R_{BE} \leqslant 50\ \Omega$	400	375	375	325	V
V_{EBO}	6	9	9	6	V
I_C	2	7	7	15	A
I_{CM} (For 10 ms max.)	5	10	10	30	A
I_B	1	4	4	10	A
P_T:* $T_C \leqslant 25^oC$	35	45	100	175	W
$T_C > 25^oC$	Derate linearly to 200°C				
T_J, T_{stg}	−65 to +200				°C
T_L (During soldering): At distances ⩾ 1/32 in. (0.8 mm) from case for 10 s max.	230				°C

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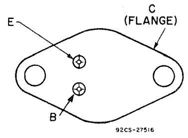
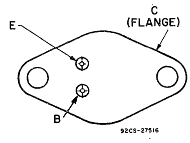
* Safe-operating-area curves for prototype devices should be extended to the maximum values of collector current for these devices.

TERMINAL DESIGNATIONS



JEDEC TO-3

40852
40853



JEDEC TO-66

40850
40851

Type 40850 (For 5-V, 25-A & 30-V, 5-A Power Supplies)
Package: JEDEC TO-66
ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C, Unless Otherwise Specified*

SYMBOL	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CEV}	V_{CE} = 450 V, V_{BE} = -1.5 V	–	0.2	mA
I_{CEV}	V_{CE} = 450 V, V_{BE} = -1.5 V, T_C = 125°C	–	2	mA
$V_{CEO}(sus)^a$	I_C = 0.2 A, I_B = 0	300	–	V
$V_{CER}(sus)^a$	I_C = 0.2 A, R_{BE} = 50 Ω	400	–	V
V_{EBO}	I_E = 5 mA, I_C = 0	6	–	V
h_{FE}	I_C = 0.75 A, V_{CE} = 10 V	25	–	
$V_{CE}(sat)$	I_C = 2 A, I_B = 0.4 A	–	2.0	V
$V_{BE}(sat)$	I_C = 2 A, I_B = 0.4 A	–	2.0	V
$I_{S/b}^a$	V_{CE} = 100 V	0.35	–	A
$E_{S/b}^a$	L = 100 μH, I_C(PEAK) = 2 A, R_{BE} = 20 Ω V_{BE} = -4 V	0.2	–	mJ

[a] For characteristics curves and test conditions, refer to published data for prototype 2N3585

Type 40851 (For 5-V, 50-A & 30-V, 10-A Power Supplies)
Package: JEDEC TO-66
ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C, Unless Otherwise Specified*

SYMBOL	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CEV}	V_{CE} = 450 V, V_{BE} = -1.5 V	–	0.5	mA
I_{CEV}	V_{CE} = 450 V, V_{BE} = -1.5 V, T_C = 125°C	–	5	mA
$V_{CEO(sus)}$[a]	I_C = 0.2 A, I_B = 0	350	–	V
$V_{CER(sus)}$[a]	I_C = 0.2 A, R_{BE} = 50 Ω	375	--	V
V_{EBO}	I_E = 1 mA, I_C = 0	9	–	V
h_{FE}	I_C = 1.2 A, V_{CE} = 1.0 V	12	–	
$V_{CE(sat)}$	I_C = 4 A, I_B = 0.8 A	–	3	V
$V_{BE(sat)}$	I_C = 4 A, I_B = 0.8 A	–	2	V
$I_{S/b}$[a]	V_{CE} = 50 V	0.9	–	A
$E_{S/b}$[a]	L = 100 μH, I_C(PEAK) = 3 A, R_{BE} = 50 Ω V_{BE} = -4 V	0.45	–	mJ

[a] For characteristics curves and test conditions, refer to published data for prototype 2N6079

Type 40852 (For 5-V, 50-A & 30-V, 10-A Power Supplies
Package: JEDEC TO-3
ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C, Unless Otherwise Specified*

SYMBOL	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CEV}	V_{CE} = 450 V, V_{BE} = -1.5 V	–	0.5	mA
I_{CEV}	V_{CE} = 450 V, V_{BE} = -1.5 V, T_C = 125°C	–	5	mA
$V_{CEO(sus)}$[a]	I_C = 0.2 A, I_B = 0	350	–	V
$V_{CER(sus)}$[a]	I_C = 0.2 A, R_{BE} = 50 Ω	375	–	V
V_{EBO}	I_E = 1 mA, I_C = 0	9	–	V
h_{FE}	I_C = 1.2 A, V_{CE} = 1.0 V	12	–	
$V_{CE(sat)}$	I_C = 4 A, I_B = 0.8 A	–	3.0	V
$V_{BE(sat)}$	I_C = 4 A, I_B = 0.8 A	–	2.0	V
$I_{S/b}$[a]	V_{CE} = 40 V	2.5	–	A
$E_{S/b}$[a]	L = 100 μH, I_C(PEAK) = 3 A, R_{BE} = 50 Ω V_{BE} = -4 V	0.45	–	mJ

[a] For characteristics curves and test conditions, refer to published data for prototype 2N5240

40850, 40851, 40852, 40854

Type 40854 (For 5-V, 200-A & 30-V, 40-A Power Supplies)
Package: JEDEC TO-3
ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C, Unless Otherwise Specified*

SYMBOL	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CEV}	V_{CE} = 450 V, V_{BE} = -1.5 V	–	1.0	mA
I_{CEV}	V_{CE} = 450 V, V_{BE} = -1.5 V, T_C = 125°C	–	10	mA
$V_{CEO}(sus)^a$	I_C = 0.2 A, I_B = 0	300	–	V
$V_{CER}(sus)^a$	I_C = 0.2 A, R_{BE} = 50 Ω	325	–	V
V_{EBO}	I_E = 5 mA, I_C = 0	6	–	V
h_{FE}	I_C = 10 A, V_{CE} = 4 V	8	–	
$V_{CE}(sat)$	I_C = 16 A, I_B = 3.2 A	–	3	V
$V_{BE}(sat)$	I_C = 16 A, I_B = 3.2 A	–	3	V
$I_{S/b}^a$	V_{CE} = 30 V	5.8	–	A
$E_{S/b}^a$	L = 50 μH, I_C(PEAK) = 10 A, R_{BE} = 50 Ω V_{BE} = -4 V	2.5	–	mJ

[a] For characteristics curves and test conditions, refer to published data for prototype 2N6251

40871, 40872

Epitaxial-Base, Silicon N-P-N and P-N-P VERSAWATT Transistors

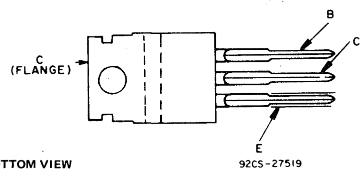
General-Purpose Types for Medium-Power Switching and Amplifier Service in Consumer, Automotive, and Industrial Applications

RCA-40871 is an epitaxial-base silicon n-p-n transistor. RCA-40872 is an epitaxial-base p-n-p transistor. These devices are intended for a wide variety of medium-power switching and amplifier applications, such as switching regulators and inverters and driver and output stages of high-fidelity amplifiers. These plastic power transistors are supplied in the JEDEC TO-220AB VERSAWATT package.

Features:

- Low saturation voltage
- VERSAWATT package
- Maximum safe-operating-area curves
- Thermal-cycling ratings

TERMINAL DESIGNATIONS



JEDEC TO-220AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	N-P-N	40871	
	P-N-P	40872*	
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:			
With external base-to-emitter resistance (R_{BE}) = 100 Ω	V_{CER}(sus)	120	V
With base open	V_{CEO}(sus)	100	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	V
COLLECTOR CURRENT (Continuous)	I_C	7	A
BASE CURRENT (Continuous)	I_B	3	A
TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 25°C		40	W
At ambient temperatures up to 25°C		1.8	W
At case temperatures above 25°C		Derate linearly at 0.32W/°C	
At ambient temperatures above 25°C		Derate linearly at 0.0144 W/°C	
TEMPERATURE RANGE:			
Storage & Operating (Junction)		−65 to 150	°C
LEAD TEMPERATURE (During Soldering):			
At distance ≥ 1/8 in. (3.17 mm) from case for 10 s max.		235	°C

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* For p-n-p device, voltage and current values are negative.

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C, Unless Otherwise Specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS		UNITS
		VOLTAGE V dc		CURRENT A dc		40871 40872*		
		V_{CE}	V_{EB}	I_C	I_B	MIN.	MAX.	
Collector-Cutoff Current: With external base-to-emitter resistance (R_{BE}) = 100 Ω	I_{CER}	110				–	1	mA
Emitter-Cutoff Current	I_{EBO}		5	0		–	1	mA
Collector-to-Emitter Sustaining Voltage: With base open	V_{CEO}(sus)			0.1	0	100	–	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	V_{CER}(sus)			0.1		120	–	V
DC Forward-Current Transfer Ratio	h_{FE}	4 4 4		1[a]		50	250	
Base-to-Emitter Voltage	V_{BE}	4 4 4		1[a]		– – –	1.5 – –	V
Collector-to-Emitter Saturation Voltage	V_{CE}(sat)			1[a]	0.1	–	1.0	V
Gain-Bandwidth Product	f_T	4		0.5		4	–	MHz
Thermal Resistance: Junction-to-Case Junction-to-Ambient	$R_{\theta JC}$ $R_{\theta JA}$					–	3.125 70	°C/W

* For p-n-p devices, voltage and current values are negative.

[a] Pulsed: Pulse duration = 300 μs, duty factor = 0.018.

CAUTION: The sustaining voltages V_{CEO}(sus) and V_{CER}(sus) MUST NOT be measured on a curve tracer.

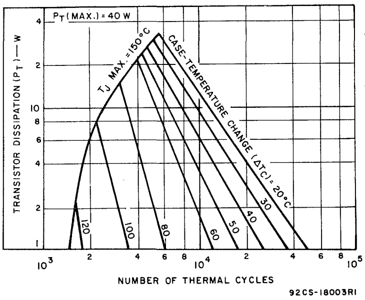


Fig. 1 - Thermal-cycling ratings for both types.

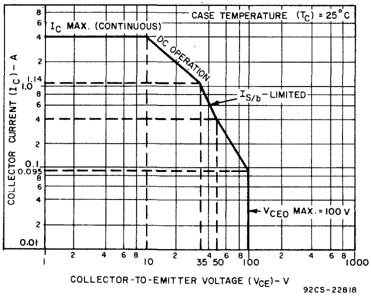


Fig. 2 - Maximum operating areas for 40871.

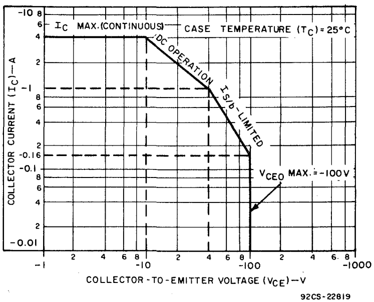


Fig. 3 - Maximum operating areas for 40872.

40871, 40872

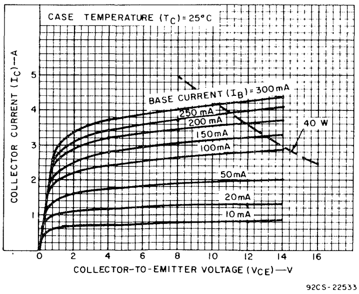


Fig. 4 - Typical output characteristics for 40871.

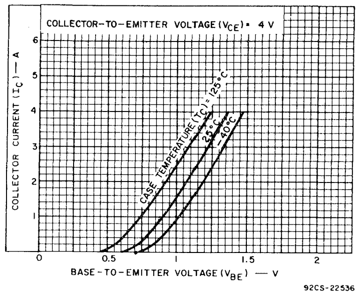


Fig. 5 - Typical transfer characteristics for 40871.

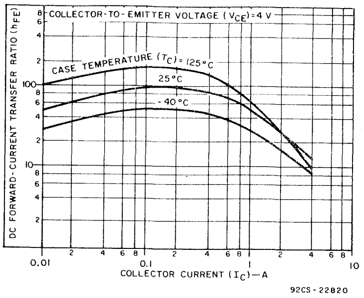


Fig. 6 - Typical dc beta characteristics for 40871.

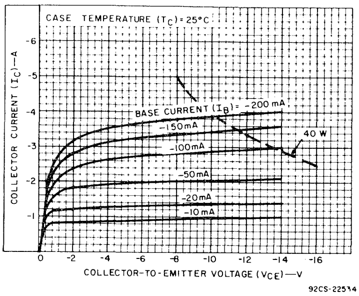


Fig. 7 - Typical output characteristics for 40872.

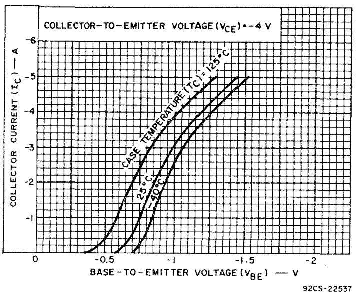


Fig. 8 - Typical transfer characteristics for 40872.

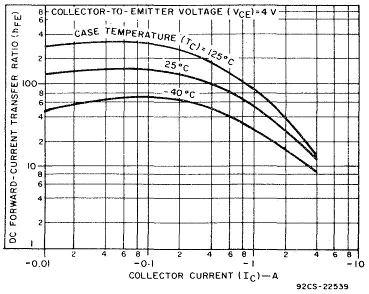


Fig. 9 - Typical dc beta characteristics for 40872.

41012, 41013

High-Current, High-Power, High-Speed Silicon N-P-N Power Transistors

For Switching and Amplifier Circuits In Industrial and Commercial Applications.

RCA-41012 and 41013 are epitaxial silicon n-p-n power transistors utilizing a multiple-emitter-site structure. They differ in breakdown-voltage ratings.

The high current-handling capability of these transistors in conjunction with fast switching speeds make the 41012 and 41013 especially suitable for switching-control amplifiers, power gates, switching regulators, converters, and inverters. Other recommended applications include dc-rf amplifiers and power oscillators. The 41012 and 41013 utilize the JEDEC TO-3 package.

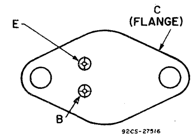
Features:

- Maximum operating area curves for dc and pulse operation
- $I_{S/b}$-limit line beginning at 28 V
- High collector-current ratings: 30 A (peak), 20 A (continuous)
- High dissipation capability: P_T = 175 W max. at T_C = 25°C
- High voltage capability: $V_{CEO}(sus)$ = 125 V (41013), 80 V (41012)
- h_{FE} = 20 min.
  t_{on} = 0.5 μs max. measured at 10 A
  t_{off} = 2 μs max.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		41013	41012	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	160	120	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:				
With base open	$V_{CEO}(sus)$	125	80	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	7	V
CONTINUOUS COLLECTOR CURRENT	I_C	20	20	A
PEAK COLLECTOR CURRENT		30	30	A
CONTINUOUS BASE CURRENT	I_B	5	5	A
TRANSISTOR DISSIPATION:	P_T			
At case temperatures up to 25°C		175	175	W
At case temperatures above 25°C		Derate linearly at 1 W/°C		
TEMPERATURE RANGE:				
Storage & Operating (Junction)		−65 to 200		°C
PIN TEMPERATURE (During Soldering)				
At distances ≥1/32 in. (0.8 mm) from seating plane for 10 s max.		230		°C

TERMINAL DESIGNATIONS



JEDEC TO-3

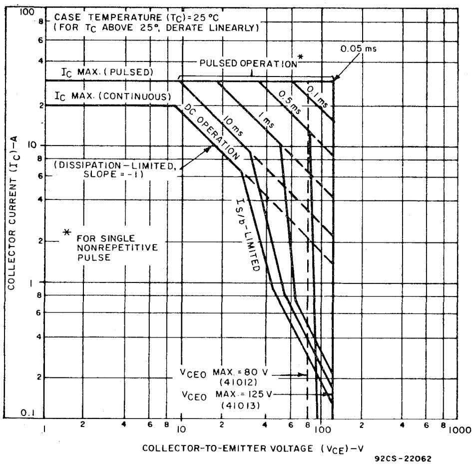


Fig. 1— Maximum operating areas for both types.

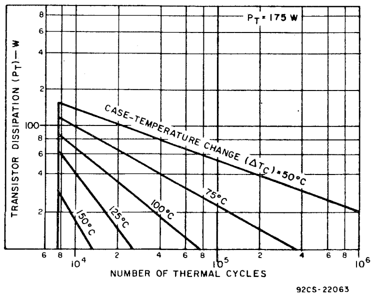


Fig. 2— Thermal-cycling rating chart for both types.

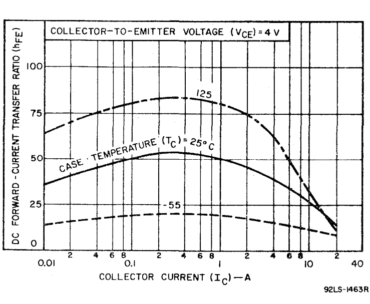


Fig. 3— Typical dc beta characteristics for both types.

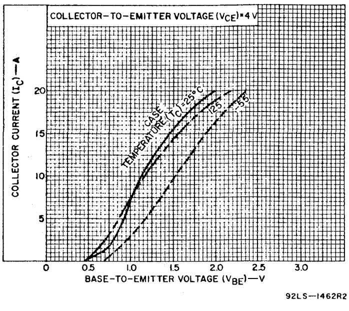


Fig. 4—Typical transfer characteristics for both types.

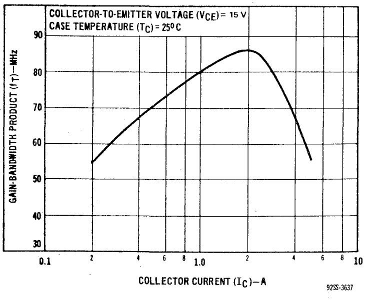


Fig. 5— Typical gain-bandwidth product for both types.

41012, 41013

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS							LIMITS						UNITS
	Voltage V dc				Current A dc			41013			41012			
	V_{CB}	V_{CE}	V_{EB}	V_{BE}	I_C	I_E	I_B	Min.	Typ.	Max.	Min.	Typ.	Max.	
I_{CBO}	120					0		–	–	10	–	–	10	mA
I_{CER} (R_{BE}) = 10 Ω, T_C = 100°C		80						–	–	10	–	–	10	
I_{EBO}			5 7		0 0			– –	– –	15 50	– –	– –	15 50	mA
h_{FE}[a]		4 4			10 20			20 –	– 15	60 –	20 –	– 15	60 –	
$\|h_{fe}\|$ (At f = 10 MHz)		15			1			4	8	–	4	8	–	
$V_{CEO}(sus)$[b]					0.2		0	125	–	–	80	–	–	V
$V_{(BR)CBO}$					0.02	0		160	–	–	120	–	–	V
V_{EBO}					0	0.05		7	–	–	7	–	–	V
V_{BE}[a]		4			10			–	1.2	–	–	1.2	–	V
$V_{CE}(sat)$[a]					10 20		1.0 2.0	– –	0.5 1.5	1.4 –	– –	0.5 1.5	1.4 –	V
$V_{BE}(sat)$[a]					10		1.0	–	1.5	2.0	–	1.5	2.0	V
C_{ob} (At 1 MHz)	10					0		–	–	300	–	–	300	pF
$I_{S/b}$[d]		28 45						6.25 0.9	– –	– –	6.25 0.9	– –	– –	A
$E_{S/b}$ R_B = 20 Ω, L = 180 μH)				−4	12			13	–	–	13	–	–	mJ
f_T (At 10 MHz)		15			1			40	80	–	40	80	–	MHz
t_{on}	V_{CC}= 30 V				10 15		1.0[c] 1.5[c]	– –	– 0.3	0.5 –	– –	– 0.3	0.5 –	μs
t_{off}	V_{CC}= 30 V				10 15		1.0[c] 1.5[c]	– –	– 1.0	2.0 –	– –	– 1.0	2.0 –	μs
$R_{\theta JC}$		10			10			–	–	1.0	–	–	1.0	°C/W

[a] Pulsed; pulse duration < 350 μs, duty factor = 2%.

[b] CAUTION: The sustaining voltage $V_{CEO}(sus)$ MUST NOT be measured on a curve tracer.

[c] I_{B_1} = I_{B_2} = value shown.

[d] Pulsed; 1-s non-repetitive pulse.

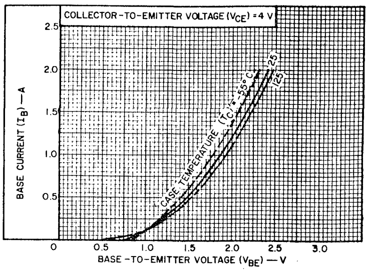


Fig. 6— Typical input characteristics for both types.

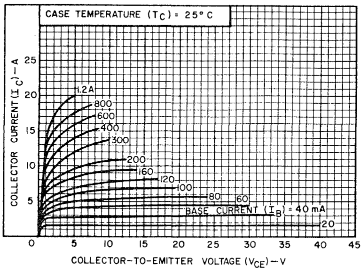


Fig. 7— Typical output characteristics for both types.

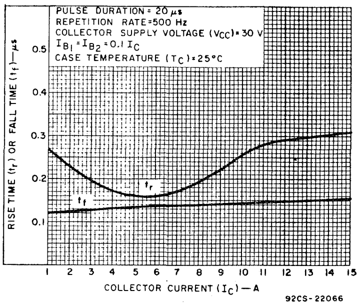


Fig. 8— Typical rise-time and fall-time characteristics for both types.

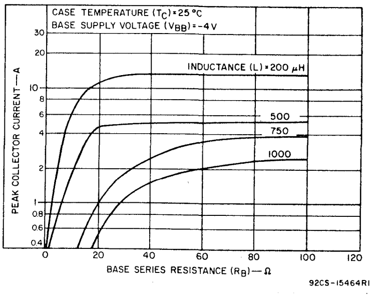


Fig. 9— Maximum reverse-bias second-breakdown characteristics for both types.

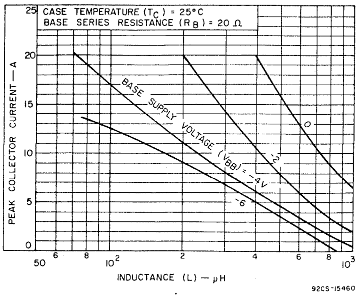


Fig. 10—Maximum reverse-bias second-breakdown characteristics for both types.

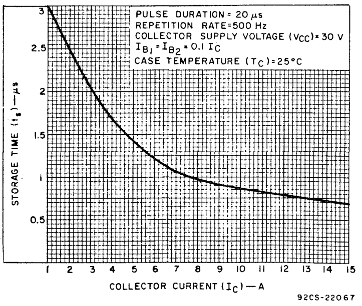


Fig. 11— Typical storage time characteristic for both types.

BD142

Hometaxial-Base, High-Power Silicon N-P-N Transistor

Rugged General-Purpose Device For Commercial Use

The RCA-BD142 is a hometaxial-base diffused-junction silicon n-p-n transistor intended for a wide variety of intermediate-power and high-power applications. It is especially suited for use in audio and inverter circuits at 12 volts.

The BD142 is supplied in a JEDEC TO-3 hermetic steel package.

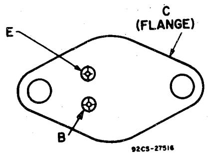
Applications:

- Series and shunt regulators
- High-fidelity amplifiers
- Power-switching circuits
- Solenoid drivers
- 12-V audio and inverter circuits

Features:

- Maximum-safe-area-of-operation curves
- Low saturation voltage
- High dissipation rating
- Thermal-cycling rating curve

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*

COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	50	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:			
With base open	$V_{CEO}(sus)$	45	V
With base reverse bias $V_{BE} = -1.5$ V	$V_{CEV}(sus)$	50	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	V
CONTINUOUS COLLECTOR CURRENT	I_C	15	A
CONTINUOUS BASE CURRENT	I_B	7	A
TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 25°C		117	W
At case temperatures above 25°C		Derate linearly to 200°C	
TEMPERATURE RANGE:			
Storage and Operating (Junction)		−65 to +200	°C
PIN TEMPERATURE (During Soldering):			
At distances ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max.		235	°C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified.*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS					LIMITS		UNITS
		VOLTAGE V dc			CURRENT A dc				
		V_{CE}	V_{EB}	V_{BE}	I_C	I_B	MIN.	MAX.	
Collector Cutoff Current: With base-emitter junction reverse-biased	I_{CEV}	40		−1.5			–	2	mA
Emitter Cutoff Current	I_{EBO}		7				–	1	mA
Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$				0.2	0	45	–	V
With base-emitter junction reverse-biased	$V_{CEV}(sus)$			−1.5	0.1		50	–	
DC Forward Current Transfer Ratio	h_{FE}	4			4^a		12.5	160	
Base-to-Emitter Voltage	V_{BE}	4			4^a		–	1.5	V
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$				4^a	0.4	–	1.1	V
Common-Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio (f = 1 kHz)	h_{fe}	4			1		10	–	
Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio (f = 0.4 MHz)	$\lvert h_{fe}\rvert$	4			1		2	–	
Gain-Bandwidth Product	f_T				1		800	–	kHz
Forward-Bias Second-Breakdown Collector Current (t ≥ 1 s)	$I_{S/b}$	39					3	–	A
Thermal Resistance (Junction-to-Case)	$R_{\theta JC}$						–	1.5	°C/W

[a] Pulsed: Pulse duration = 300 μs, duty factor = 2%.

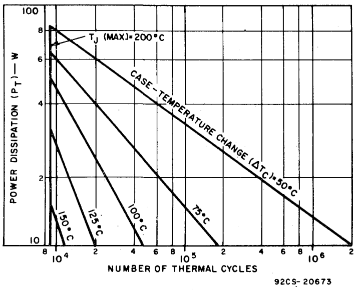


Fig. 1 — Thermal-cycling rating chart.

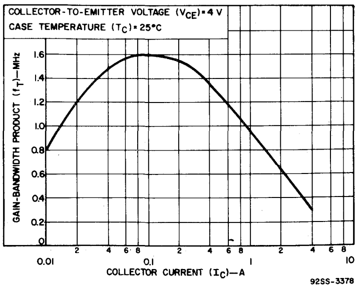


Fig. 2 — Typical gain-bandwidth product.

BD142

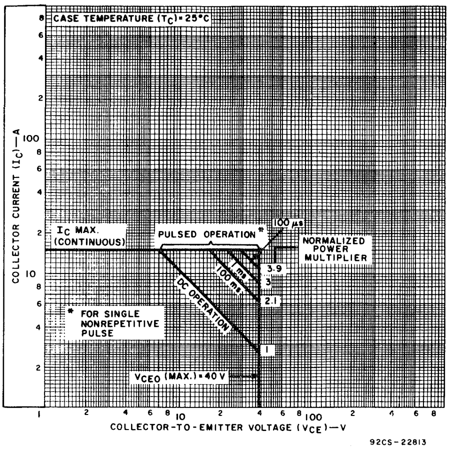


Fig. 3 — Maximum safe area of operation.

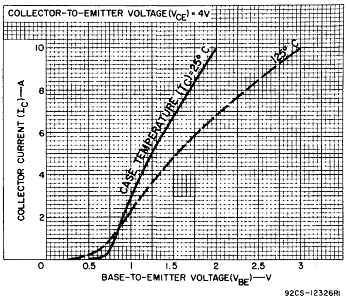


Fig. 4 — Typical transfer characteristics.

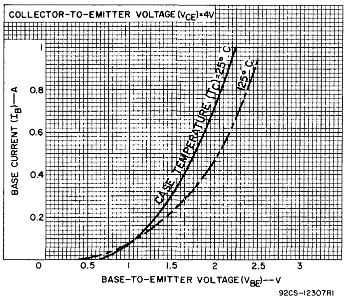


Fig. 5 — Typical input characteristics.

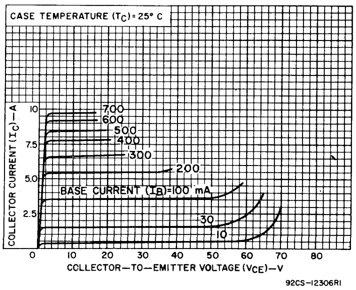


Fig. 6 — Typical output characteristics.

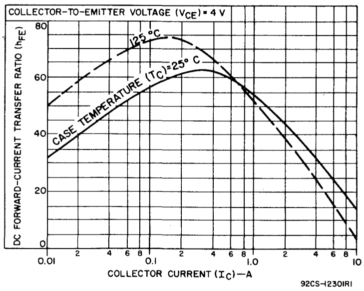


Fig. 7 — Typical dc beta characteristics.

BD181, BD182, BD183

Hometaxial-Base, High-Power Silicon N-P-N Transistors

Rugged, Broadly Applicable Devices For Commercial Use

RCA-BD181, BD182 and BD183 are silicon n-p-n transistors intended for a wide variety of high-power applications. The hometaxial-base construction of these devices renders them highly resistant to second breakdown over a wide range of operating conditions.

These transistors are supplied in a JEDEC TO-3 hermetic steel package.

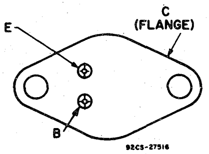
Applications:

- **Series and shunt regulators**
- **High-fidelity amplifiers**
- **Power-switching circuits**
- **Solenoid drivers**

Features:

- **Maximum safe-area-of-operation curves**
- **Low saturation voltages**
- **High dissipation ratings**
- **Thermal-cycling rating curves**

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		BD181	BD182	BD183	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	55	70	85	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:					
With external base-to-emitter resistance (R_{BE}) = 100 Ω	$V_{CER}(sus)$	55	70	85	V
With base open	$V_{CEO}(sus)$	45	60	80	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	7	7	V
CONTINUOUS COLLECTOR CURRENT	I_C	15	15	15	A
CONTINUOUS BASE CURRENT	I_B	7	7	7	A
TRANSISTOR DISSIPATION:	P_T				
At case temperatures up to 25°C		117	117	117	W
At case temperatures above 25°C		← See Fig. 2 →			
TEMPERATURE RANGE:					
Storage and Operating (Junction)		← −65 to +200 →			°C
PIN TEMPERATURE (During Soldering):					
At distances ⩾ 1/32 in. (0.8 mm) from seating plane for 10 s max.		← 235 →			°C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS						LIMITS						UNITS
		VOLTAGE V dc				CURRENT A dc		BD181		BD182		BD183		
		V_{CB}	V_{CE}	V_{EB}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
Collector-Cutoff Current: With emitter open and T_C = 200°C	I_{CBO}	45					0	–	2	–	–	–	–	mA
		60					0	–	–	–	5	–	–	
		80					0	–	–	–	–	–	5	
With base-emitter junction reverse-biased	I_{CEX}		45		−1.5				1	–	–	–	–	
			60		−1.5			–	–	–	1	–	–	
			80		−1.5			–	–	–	–	–	1	
Emitter-Cutoff Current	I_{EBO}			7				–	5	–	5	–	5	mA
Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$					0.2^a	0	45	–	60	–	80	–	V
With external base-to-emitter resistance (R_{BE})=100 Ω	$V_{CER}(sus)$					0.2^a		55	–	70	–	85	–	
DC Forward Current Transfer Ratio	h_{FE}		4			4^a		–	–	20	70	–	–	
			4			3^a		20	70	–	–	20	70	
Base-to-Emitter Voltage	V_{BE}		4			3^a		–	1.5	–	–	–	1.5	V
			4			4^a		–	–	–	1.5	–	–	
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$					4^a	0.4^a	–	–	–	1	–	–	V
						3^a	0.3^a	–	1	–	–	–	1	
Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio (f = 0.4 MHz)	$\|h_{fe}\|$		4			1		2	–	2	–	2	–	
Gain-Bandwidth Product	f_T					1		800	–	800	–	800	–	kHz
Common-Emitter, Short-Circuit, Small-Signal, Forward Current Transfer Ratio Cutoff Frequency	f_{hfe}		4			0.3		15	–	15	–	15	–	kHz
Forward-Bias Second Breakdown Collector Current (t ⩾ 1 s)	$I_{S/b}$		30					3.95	–	3.95	–	3.95	–	A
Thermal Resistance (Junction-to-Case)	$R_{\theta JC}$							–	1.5	–	1.5	–	1.5	°C/W

[a] Pulsed: Pulse duration = 300 μs, duty factor = 1.8%.

BD181, BD182, BD183

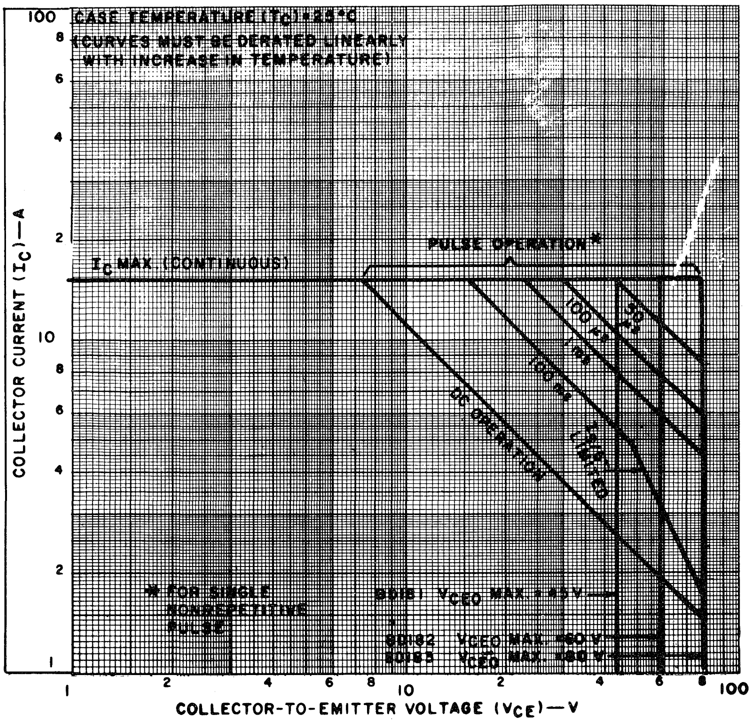


Fig. 1 — Maximum operating areas for all types.

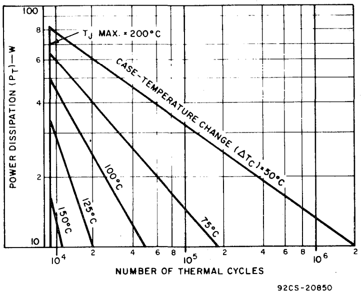


Fig. 2 — Thermal cycling rating chart for all types.

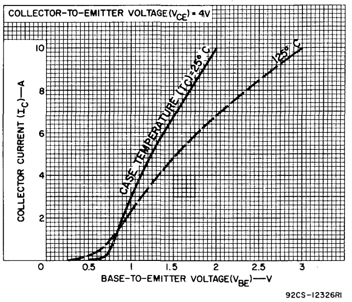


Fig. 3 — Typical transfer characteristics for all types.

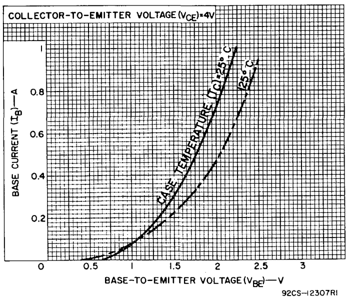


Fig. 4 — Typical input characteristics for BD182.

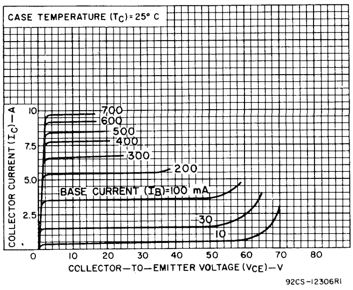


Fig. 5 — Typical output characteristics for BD182.

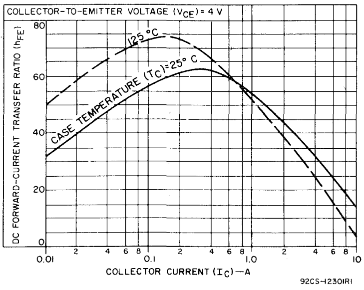


Fig. 6 — Typical dc-beta characteristics for BD182.

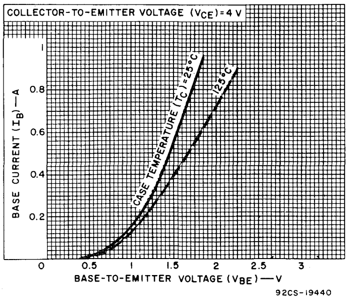


Fig. 7 — Typical input characteristics for BD181 and BD183.

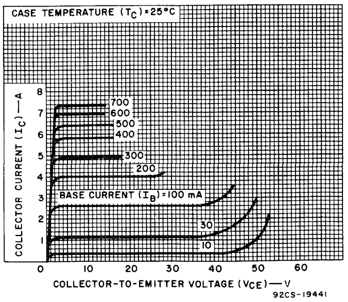


Fig. 8 — Typical output characteristics for BD181 and BD183.

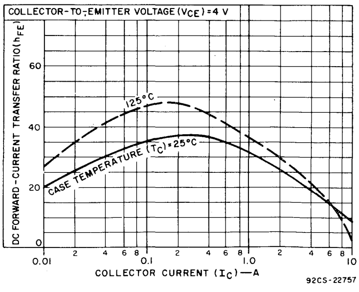


Fig. 9 — Typical dc-beta characteristics for BD181 and BD183.

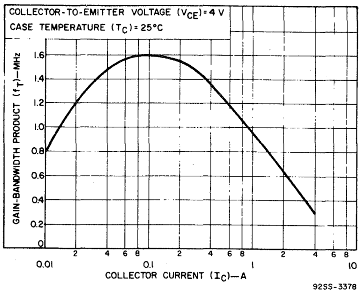


Fig. 10 — Typical gain-bandwidth product for all types.

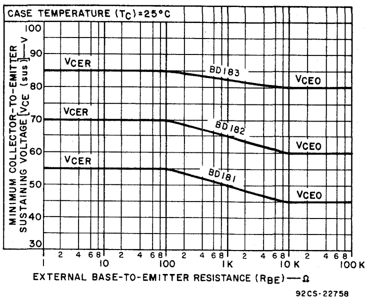


Fig. 11 — Sustaining voltage vs. base-to-emitter resistance for all types.

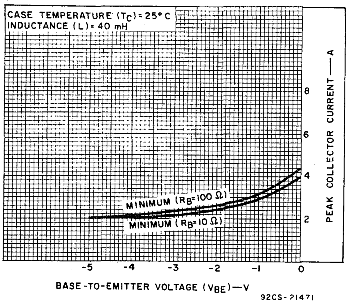


Fig. 12 — Minimum reverse-bias second-breakdown characteristics for all types.

BD239, BD239A, BD239B, BD239C, BD240, BD240A, BD240B, BD240C

Epitaxial-Base Silicon N-P-N and P-N-P VERSAWATT Transistors

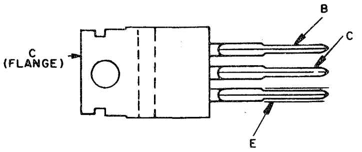
For Power-Amplifier and High-Speed-Switching Applications

Features:
- 30 W at 25°C case temperature
- 4-A rated collector current
- Min. f_T of 3 MHz at 10 V, 200 mA

These RCA devices are epitaxial-base silicon n-p-n and p-n-p transistors; they differ only in their voltage ratings. These transistors are intended for a wide variety of switching and amplifier applications such as series and shunt regulators, and driver and output stages of high-fidelity amplifiers. The BD240-series p-n-p power transistors are complements of the n-p-n devices in the BD239 series.

All these transistors are supplied in the JEDEC TO-220AB straight-lead version of the VERSAWATT package. Optional lead configurations are available upon request. For information, contact your nearest RCA International Sales Office.

TERMINAL DESIGNATIONS



BOTTOM VIEW
JEDEC TO-220 AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		BD239 BD240◆	BD239A BD240A◆	BD239B BD240B◆	BD239C BD240C◆	
COLLECTOR-TO-EMITTER VOLTAGE:						
With external base-to-emitter resistance (R_{BE}) = 100 Ω	V_{CER}	55	70	90	115	V
With base open	V_{CEO}	45	60	80	100	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	5	5	5	V
CONTINUOUS COLLECTOR CURRENT	I_C	4	4	4	4	A
CONTINUOUS BASE CURRENT	I_B	1	1	1	1	A
TRANSISTOR DISSIPATION:	P_T					
At case temperatures up to 25°C		30	30	30	30	W
At ambient temperatures up to 25°C .		2	2	2	2	W
At case temperatures above 25°C			Derate linearly to 150°C			
TEMPERATURE RANGE:						
Storage & Operating (Junction)			← −65 to 150 →			°C
LEAD TEMPERATURE (During Soldering):						
At distance 1/8 in. (3.17 mm) from case for 10 s max.			← 235 →			°C

◆ For p-n-p devices, voltage and current values are negative.

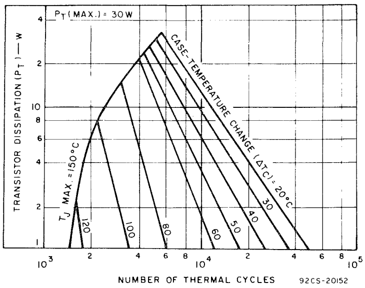


Fig. 1 — Thermal-cycling ratings for all types.

ELECTRICAL CHARACTERISTICS *at Case Temperature (T_C) = 25°C*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS◆				LIMITS								UNITS
		VOLTAGE V dc		CURRENT A dc		BD239 BD240◆		BD239A BD240A◆		BD239B BD240B◆		BD239C BD240C◆		
		V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
Collector Cutoff Current: With base open	I_{CEO}	−30 −60			0 0	– –	−0.3 –	– –	−0.3 –	– –	– −0.3	– –	– −0.3	mA
With base-to-emitter junction short-circuited	I_{CES}	−45 −60 −80 −100	0 0 0 0			– – – –	−0.2 – – –	– – – –	– −0.2 – –	– – – –	– – −0.2 –	– – – –	– – – −0.2	
Emitter Cutoff Current	I_{EBO}		5	0		–	−1	–	−1	–	−1	–	−1	mA
Collector-to-Emitter Breakdown Voltage: With base open	$V_{BR(CEO)}$			−0.03[a]	0	−45	–	−60	–	−80	–	−100	–	V
DC Forward-Current Transfer Ratio	h_{FE}	−4 −4		−0.2[a] −1[a]		40 15	– –	40 15	– –	40 15	– –	40 15	– –	
Base-to-Emitter Voltage	V_{BE}	−4		−1[a]		–	−1.3	–	−1.3	–	−1.3	–	−1.3	V
Collector-to-Emitter Saturation Voltage	V_{CE}(sat)			−1[a]	−0.2	–	−0.7	–	−0.7	–	−0.7	–	−0.7	V
Common-Emitter Small-Signal Short-Circuit Forward-Current Transfer Ratio (f = 1 kHz)	h_{fe}	−10		−0.2		20	–	20	–	20	–	20	–	
Magnitude of Common Emitter Small-Signal Short-Circuit Forward-Current Transfer Ratio (f = 1 MHz)	$\|h_{fe}\|$	−10		−0.2		3	–	3	–	3	–	3	–	
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$					–	4.17	–	4.17	–	4.17	–	4.17	°C/W
Junction-to-Ambient	$R_{\theta JA}$					–	62.5	–	62.5	–	62.5	–	62.5	

◆ For p-n-p devices, voltage and current values are negative.

[a] Pulsed: Pulse duration = 300 μs, duty factor = 2%.

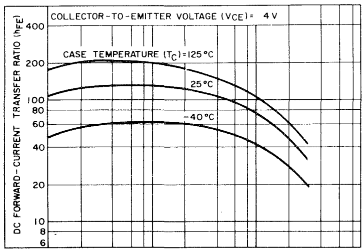


Fig. 2 — Typical dc beta characteristics for BD239-series types.

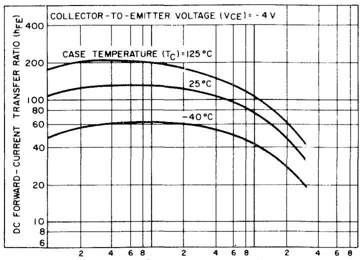


Fig. 3 — Typical dc beta characteristics for BD240-series types.

BD239, BD239A, BD239B, BD239C, BD240, BD240A, BD240B, BD240C

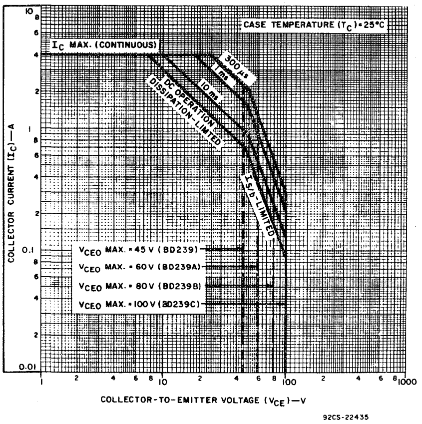


Fig. 4 — Maximum safe operating areas for BD239-series types.

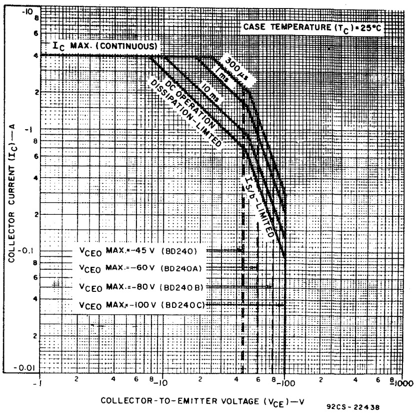


Fig. 5 — Maximum safe operating areas for BD240-series types.

BD241, BD241A, BD241B, BD241C, BD242, BD242A, BD242B, BD242C

Epitaxial-Base Silicon N-P-N and P-N-P VERSAWATT Transistors

For Power-Amplifier and High-Speed-Switching Applications

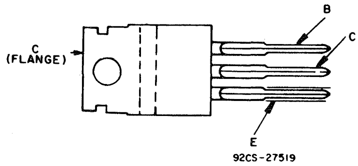
These RCA devices are epitaxial-base silicon n-p-n and p-n-p transistors; they differ only in their voltage ratings. These transistors are intended for a wide variety of switching and amplifier applications such as series and shunt regulators, and driver and output stages of high-fidelity amplifiers. The BD242-series p-n-p power transistors are complements of the n-p-n devices in the BD241 series.

All these transistors are supplied in the JEDEC TO-220AB straight-lead version of the VERSAWATT package. Optional lead configurations are available upon request. For information, contact your nearest RCA International Sales Office.

Features:

- **40 W at 25°C case temperature**
- **5-A rated collector current**
- **Min. f_T of 3 MHz at 10 V, 500 mA**

TERMINAL DESIGNATIONS



BOTTOM VIEW
JEDEC TO-220 AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		BD241 BD242◆	BD241A BD242A◆	BD241B BD242B◆	BD241C BD242C◆	
COLLECTOR-TO-EMITTER VOLTAGE:						
With external base-to-emitter resistance (R_{BE}) = 100 Ω	V_{CER}	55	70	90	115	V
With base open	V_{CEO}	45	60	80	100	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	5	5	5	V
CONTINUOUS COLLECTOR CURRENT	I_C	5	5	5	5	A
CONTINUOUS BASE CURRENT	I_B	1	1	1	1	A
TRANSISTOR DISSIPATION:	P_T					
At case temperatures up to 25°C		40	40	40	40	W
At ambient temperatures up to 25°C		2	2	2	2	W
At case temperatures above 25°C		Derate linearly to 150°C				
TEMPERATURE RANGE:						
Storage & Operating (Junction)		← −65 to 150 →				°C
LEAD TEMPERATURE (During Soldering):						
At distance 1/8 in. (3.17 mm) from case for 10 s max.		← 235 →				°C

◆ For p-n-p devices, voltage and current values are negative.

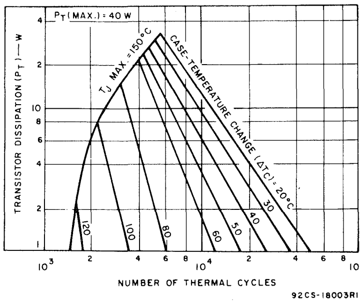


Fig. 1 — Thermal-cycling ratings for all types.

ELECTRICAL CHARACTERISTICS *at Case Temperature* (T_C) *= 25°C*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS◆				LIMITS								UNITS
		VOLTAGE V dc		CURRENT A dc		BD241 BD242◆		BD241A BD242A◆		BD241B BD242B◆		BD241C BD242C◆		
		V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
Collector Cutoff Current: With base open	I_{CEO}	30 60			0 0	– –	0.3 –	– –	0.3 –	– –	– 0.3	– –	– 0.3	mA
With base-to-emitter junction short-circuited	I_{CES}	45 60 80 100	0 0 0 0			– – – –	0.2 – – –	– – – –	– 0.2 – –	– – – –	– – 0.2 –	– – – –	– – – 0.2	
Emitter Cutoff Current	I_{EBO}		−5	0		–	1	–	1	–	1	–	1	mA
Collector-to-Emitter Breakdown Voltage: With base open	$V_{BR(CEO)}$			0.03^a	0	45	–	60	–	80	–	100	–	V
DC Forward-Current Transfer Ratio	h_{FE}	4 4		1^a 3^a		25 10	– –	25 10	– –	25 10	– –	25 10	– –	
Base-to-Emitter Voltage	V_{BE}	4		3^a		–	1.8	–	1.8	–	1.8	–	1.8	V
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$			3^a	0.6	–	1.2	–	1.2	–	1.2	–	1.2	V
Common-Emitter Small-Signal Short-Circuit Forward-Current Transfer Ratio (f = 1 kHz)	h_{fe}	10		0.5		20	–	20	–	20	–	20	–	
Magnitude of Common Emitter Small-Signal Short-Circuit Forward-Current Transfer Ratio (f = 1 MHz)	$\lvert h_{fe} \rvert$	10		0.5		3	–	3	–	3	–	3	–	
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$					–	3.125	–	3.125	–	3.125	–	3.125	°C/W
Junction-to-Ambient	$R_{\theta JA}$					–	62.5	–	62.5	–	62.5	–	62.5	

^{a}Pulsed: Pulse duration = 300 μs, duty factor = 2%.

◆ For p-n-p devices, voltage and current values are negative.

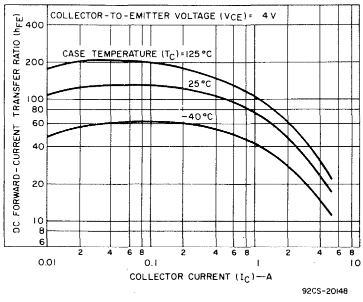


Fig. 2 — Typical dc beta characteristics for BD241-series types.

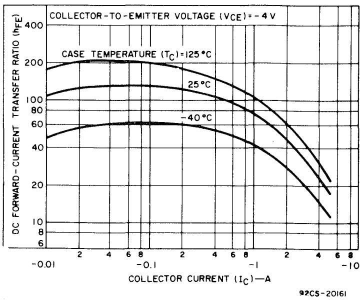


Fig. 3 — Typical dc beta characteristics for BD242-series types.

BD241, BD241A, BD241B, BD241C, BD242, BD242A, BD242B, BD242C

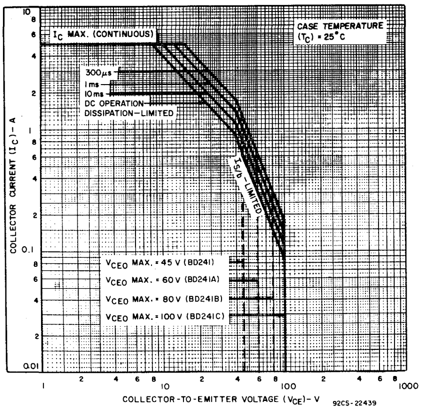


Fig. 4 — Maximum safe operating areas for BD241-series types.

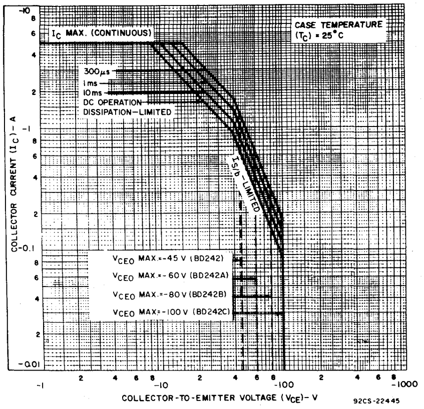


Fig. 5 — Maximum safe operating areas for BD242-series types.

BD243, BD243A, BD243B BD243C, BD244, BD244A BD244B, BD244C

Epitaxial-Base Silicon N-P-N and P-N-P VERSAWATT Transistors

For Power-Amplifier and High-Speed-Switching Applications

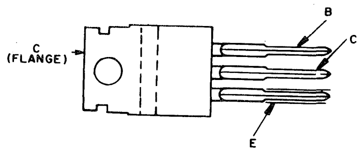
These RCA devices are epitaxial-base silicon n-p-n and p-n-p transistors; they differ only in their voltage ratings. These transistors are intended for a wide variety of switching and amplifier applications such as series and shunt regulators, and driver and output stages of high-fidelity amplifiers. The BD244-series p-n-p power transistors are complements of the n-p-n devices in the BD243 series.

All these transistors are supplied in the JEDEC TO-220AB straight-lead version of the VERSAWATT package. Optional lead configurations are available upon request. For information, contact your nearest RCA International Sales Office.

Features:

- **65 W at 25°C case temperature**
- **7-A rated collector current**
- **Min. f_T of 3 MHz at 10 V, 500 mA**

TERMINAL DESIGNATIONS



BOTTOM VIEW
JEDEC TO-220 AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		BD243 BD244◆	BD243A BD244A◆	BD243B BD244B◆	BD243C BD244C◆	
COLLECTOR-TO-EMITTER VOLTAGE:						
With external base-to-emitter resistance (R_{BE}) = 100 Ω	V_{CER}	55	70	90	115	V
With base open	V_{CEO}	45	60	80	100	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	5	5	5	V
CONTINUOUS COLLECTOR CURRENT	I_C	4	4	4	4	A
CONTINUOUS BASE CURRENT	I_B	1	1	1	1	A
TRANSISTOR DISSIPATION:	P_T					
At case temperatures up to 25°C		30	30	30	30	W
At ambient temperatures up to 25°C		2	2	2	2	W
At case temperatures above 25°C		Derate linearly to 150°C				
TEMPERATURE RANGE:						
Storage & Operating (Junction)		← −65 to 150 →				°C
LEAD TEMPERATURE (During Soldering):						
At distance 1/8 in. (3.17 mm) from case for 10 s max.		← 235 →				°C

◆ For p-n-p devices, voltage and current values are negative.

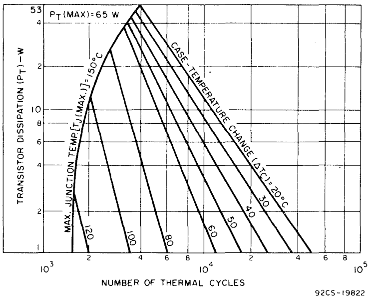


Fig. 1 — Thermal-cycling ratings for all types.

ELECTRICAL CHARACTERISTICS *at Case Temperature (T_C) = 25°C*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS◆				LIMITS								UNITS
		VOLTAGE V dc		CURRENT A dc		BD243 BD244◆		BD243A BD244A◆		BD243B BD244B◆		BD243C BD244C◆		
		V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
Collector Cutoff Current: With base open	I_{CEO}	30			0	–	0.7	–	0.7	–	–	–	–	mA
		60			0	–	–	–	–	–	0.7	–	0.7	
With base-to-emitter junction short-circuited	I_{CES}	45	0			–	0.4	–	–	–	–	–	–	
		60	0			–	–	–	0.4	–	–	–	–	
		80	0			–	–	–	–	–	0.4	–	–	
		100	0			–	–	–	–	–	–	–	0.4	
Emitter Cutoff Current	I_{EBO}		−5	0		–	1	–	1	–	1	–	1	mA
Collector-to-Emitter Breakdown Voltage: With base open	$V_{BR(CEO)}$			0.03^a	0	45	–	60	–	80	–	100	–	V
DC Forward-Current Transfer Ratio	h_{FE}	4		0.3^a		30	–	30	–	30	–	30	–	
		4		3^a		15	–	15	–	15	–	15	–	
Base-to-Emitter Voltage	V_{BE}	4		6^a		–	2	–	2	–	2	–	2	V
Collector-to-Emitter Saturation Voltage	V_{CE}(sat)			6^a	1	–	1.5	–	1.5	–	1.5	–	1.5	V
Common-Emitter Small-Signal Short-Circuit Forward-Current Transfer Ratio (f = 1 kHz)	h_{fe}	10		0.5		20	–	20	–	20	–	20	–	
Magnitude of Common Emitter Small-Signal Short-Circuit Forward-Current Transfer Ratio (f = 1 MHz)	$\lvert h_{fe} \rvert$	10		0.5		3	–	3	–	3	–	3	–	
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$					–	1.92	–	1.92	–	1.92	–	1.92	°C/W
Junction-to-Ambient	$R_{\theta JA}$					–	62.5	–	62.5	–	62.5	–	62.5	

[a] Pulsed: Pulse duration = 300 μs, duty factor = 2%.

◆ For p-n-p devices, voltage and current values are negative.

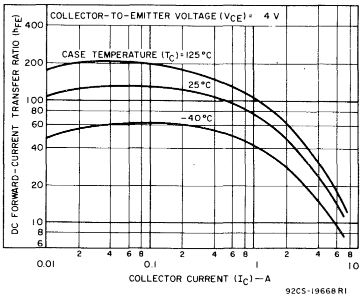


Fig. 2 — Typical dc beta characteristics for BD243-series types.

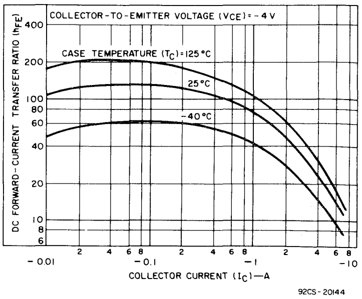


Fig. 3 — Typical dc beta characteristics for BD244-series types.

BD243, BD243A, BD243B, BD243C, BD244, BD244A, BD244B, BD244C

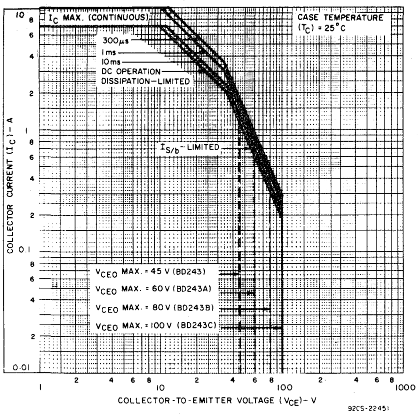


Fig. 4 — Maximum safe operating areas for BD243-series types.

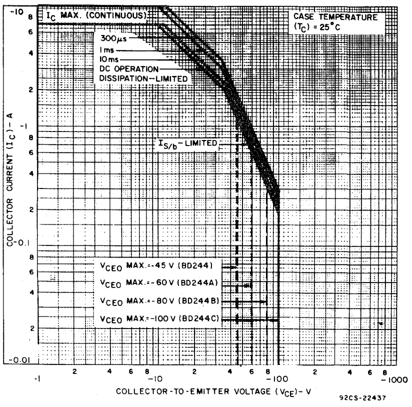


Fig. 5 — Maximum safe operating areas for BD244-series types.

BD277

7-A, 70-W, Epitaxial-Base, Silicon P-N-P VERSAWATT Transistor

For Applications in Series and Shunt Regulators

Features:

- Thermal-cycling ratings
- Maximum-safe-area-of-operation curve
- Low saturation voltage
- VERSAWATT package (molded silicone plastic)
- High power-dissipation capability

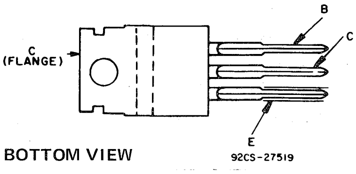
Type BD277 is an epitaxial-base silicon p-n-p transistor supplied in the JEDEC TO-220AB straight-lead VERSAWATT package. It is also available in the TO-220AA package (leads formed to fit a TO-66 socket); to order this version, specify formed lead No. 6201.

The BD277 is useful in series regulators and shunt regulators because of its low saturation voltage and high power-dissipation capability. It is also useful as a replacement for germanium p-n-p transistors in many applications.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

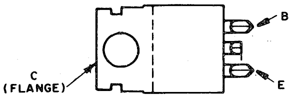
COLLECTOR-TO-BASE VOLTAGE:			
With emitter open	V_{CBO}	–45	V
COLLECTOR-TO-EMITTER VOLTAGE:			
With base open	V_{CEO}	–45	V
EMITTER-TO-BASE VOLTAGE:			
With collector open	V_{EBO}	–4	V
COLLECTOR CURRENT (Continuous)	I_C	–7	A
BASE CURRENT (Continuous)	I_B	–3	A
TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 25°C		70	W
At case temperatures above 25°C		Derate linearly at 0.56 W/°C	
TEMPERATURE RANGE:			
Storage & Operating (Junction)		–65 to 150	°C
LEAD TEMPERATURE (During Soldering):			
At distance ⩾ 1/8 in. (3.17 mm) from case for 10 s max.		235	°C

TERMINAL DESIGNATIONS



BOTTOM VIEW 92CS-27519

TO-220AB



BOTTOM VIEW 92CS-27520

TO-220AA

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless specified otherwise*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS						LIMITS		UNITS
		VOLTAGE V dc			CURRENT A dc					
		V_{CE}	V_{CB}	V_{EB}	I_C	I_B	I_E	MIN.	MAX.	
Collector Cutoff Current: With emitter open	I_{CBO}		–45				0	–	–0.1	mA
With emitter open and T_C = 150°C			–40				0	–	–2.0	
With base open	I_{CEO}	–30				0		–	–1.0	
Emitter Cutoff Current: With collector open	I_{EBO}			–4	0			–	–1.0	mA
Collector-to-Emitter Breakdown Voltage: With base open	$V_{(BR)CEO}$				–0.1*	0		–45	–	V
Base-to-Emitter Voltage	V_{BE}	–2			–1.75*			–	1.2	V
DC Forward-Current Transfer Ratio	h_{FE}	–2			–1.75*			30	150	
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$				–1.75*	–0.1		–	–0.5	V
Gain-Bandwidth Product	f_T	–4			–0.5			10	–	MHz
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$							–	1.78	°C/W
Junction-to-Ambient	$R_{\theta JA}$							–	70	

* Pulsed: Pulse duration = 300 μs, duty factor ⩽ 2%.

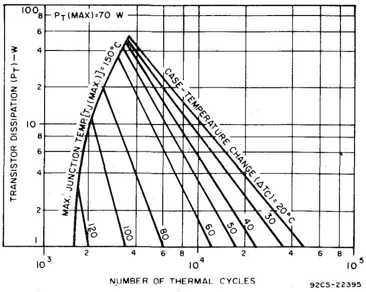


Fig. 1 — Thermal-cycling ratings.

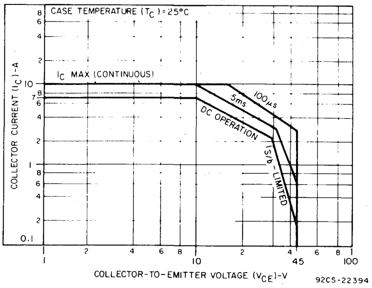


Fig. 2 — Maximum operating area.

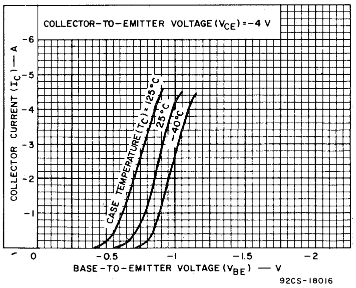


Fig. 3 — Typical transfer characteristics.

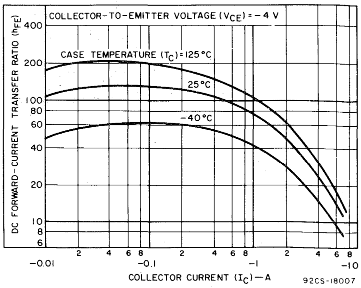


Fig. 4 — Typical dc beta characteristics.

BD278, BD278A

High-Current Silicon N-P-N VERSAWATT Transistor

For Medium-Power Linear and Switching Service in Consumer, Automotive, and Industrial Applications

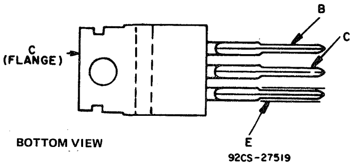
The RCA BD278 and BD278A are hometaxial-base silicon n-p-n transistors supplied in the JEDEC TO-220AB straight-lead VERSAWATT package. They are also available in the TO-220AA package (leads formed to fit a TO-66 socket); to order this version, specify formed lead No. 6201.

These transistors are intended for a wide variety of medium-power switching and linear applications such as series regulators, solenoid drivers, motor-speed controls, inverters, output stages for high-fidelity amplifiers, and power supply and vertical-deflection circuits for monochrome and color TV.

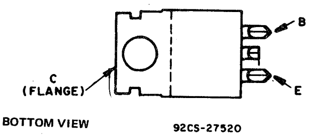
Features:

- Low saturation voltage:
  $V_{CE}(sat) = 1$ V max. at $I_C = 4$ A
- VERSAWATT package (molded-silicon plastic)
- Maximum-safe-area-of-operation curve
- Thermal-cycling rating curve

TERMINAL DESIGNATIONS



JEDEC TO-220AB



JEDEC TO-220AA

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		BD278	BD278A	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	55	70	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:				
With external base-to-emitter resistance (R_{BE}) = 100Ω	$V_{CER}(sus)$	55	70	V
With base open	$V_{CEO}(sus)$	45	60	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	5	V
COLLECTOR CURRENT (Continuous)	I_C	10	10	A
BASE CURRENT	I_B	4	4	A
TRANSISTOR DISSIPATION:	P_T			
At case temperatures up to 25°C		75	75	W
At ambient temperatures up to 25°C		1.8	1.8	W
At case temperatures above 25°C, derate linearly		0.6	0.6	W/°C
At ambient temperatures above 25°C, derate linearly		0.0144	0.0144	W/°C
TEMPERATURE RANGE:				
Storage & Operating (Junction)		−65 to 150		°C
LEAD TEMPERATURE (During Soldering):				
At distance ⩾ 1/8 in. (3.17 mm) from case for 10 s max.		235		°C

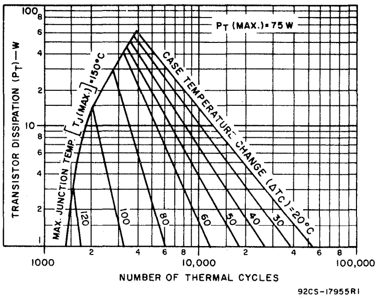


Fig. 1 — Thermal-cycling ratings.

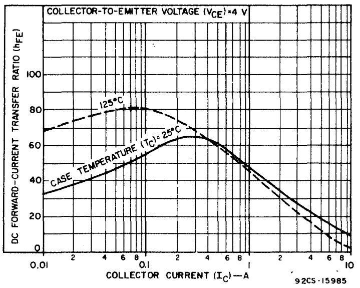


Fig. 2 — Typical dc beta characteristics.

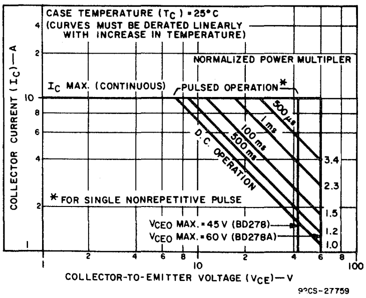


Fig. 3 — Maximum safe operating area.

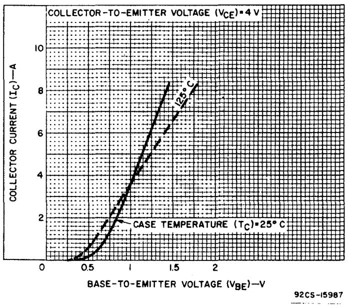


Fig. 4 — Typical transfer characteristics.

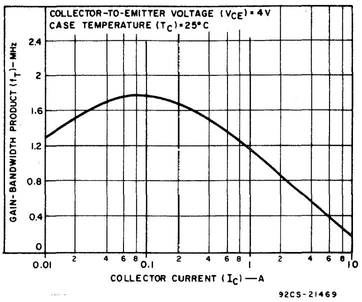


Fig. 5 — Typical gain bandwidth product.

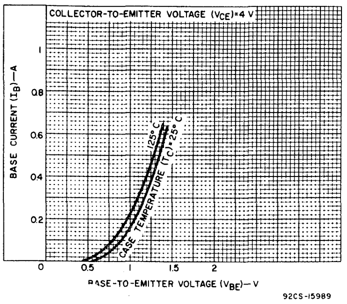


Fig. 6 — Typical input characteristics.

BD278, BD278A

ELECTRICAL CHARACTERISTICS, *at Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS				UNITS
		VOLTAGE V dc		CURRENT A dc		BD278		BD278A		
		V_{CE}	V_{EB}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	
Collector Cutoff Current:										
With base-to-emitter junction reverse-biased	I_{CEX}	55	1.5			–	2	–	–	mA
		70	1.5			–	–	–	2	
With base-to-emitter junction reverse-biased and T_C= 150°C		50	1.5			–	10	–	–	mA
		65	1.5			–	–	–	10	
With base open	I_{CEO}	30			0	–	2	–	–	
		45			0	–	–	–	2	
Emitter Cutoff Current	I_{EBO}		5			–	5	–	5	mA
Collector-to-Emitter Sustaining Voltage: With external base-to-emitter resistance (R_{BE})= 100Ω[a]	$V_{CER}(sus)$			0.2		55	–	70	–	V
With base open[a]	$V_{CEO}(sus)$			0.2	0	45	–	60	–	
DC Forward-Current Transfer Ratio[a]	h_{FE}	4		4		15	75	15	75	
Base-to-Emitter Voltage[a]	V_{BE}	4		4		–	1.8	–	1.8	V
Collector-to-Emitter Saturation Voltage[a]	$V_{CE}(sat)$			4	0.4	–	1	–	1	V
Common-Emitter Small-Signal Short-Circuit Forward-Current Transfer Ratio (f = 1 kHz)	h_{fe}	4		0.5		15	–	15	–	
Magnitude of Common-Emitter Small-Signal Short-Circuit Forward-Current Transfer Ratio (f = 0.1 MHz)	h_{fe}	4		0.5		8	28	8	28	
Forward-Bias Second-Breakdown Collector Current (t= 0.5 s)	$I_{S/b}$	40				1.87	–	1.87	–	A
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$					–	1.67	–	1.67	°C/W
Junction-to-Ambient	$R_{\theta JA}$					–	70	–	70	

[a] Pulsed, pulse duration = 300μs, duty factor = 0.018

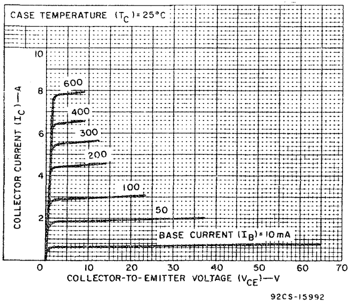


Fig. 7 – Typical output characteristics.

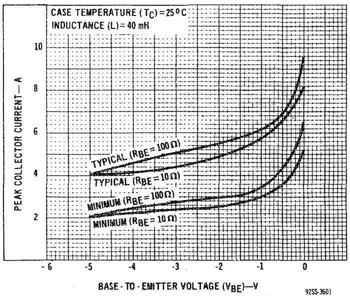


Fig. 8 – Reverse-bias second-breakdown characteristics.

BDX33, BDX33A, BDX33B, BDX33C, BDX33D, BDX34, BDX34A, BDX34B, BDX34C

10-Ampere N-P-N and P-N-P Darlington Power Transistors

40-60-80-100-120 Volts, 70 Watts

Gain of 750 at 4 A (BDX33, BDX33A, BDX34, BDX34A)
Gain of 750 at 3 A (BDX33B, BDX33C, BDX33D, BDX34B, BDX34C)

These RCA devices are monolithic silicon n-p-n and p-n-p Darlington transistors designed for low- and medium-frequency power applications. The high gain of these devices makes it possible for them to be driven directly from integrated circuits. The BDX33, BDX33A, BDX33B, and BDX33C n-p-n transistors are complementary to the BDX34, BDX34A, BDX34B, and BDX34C p-n-p devices.

All these transistors are supplied in the JEDEC TO-220AB package.

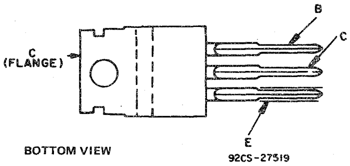
Features:

- Operates from IC without predriver
- Low leakage at high temperature
- High reverse second-breakdown capability

Applications:

- Power switching
- Hammer drivers
- Series and shunt regulators
- Audio amplifiers

TERMINAL DESIGNATIONS

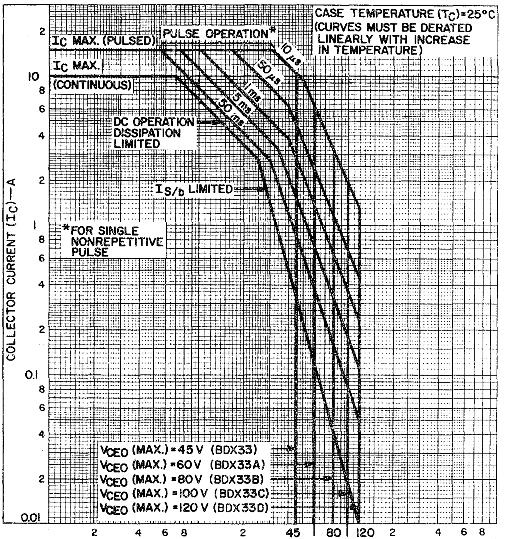


JEDEC TO-220AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

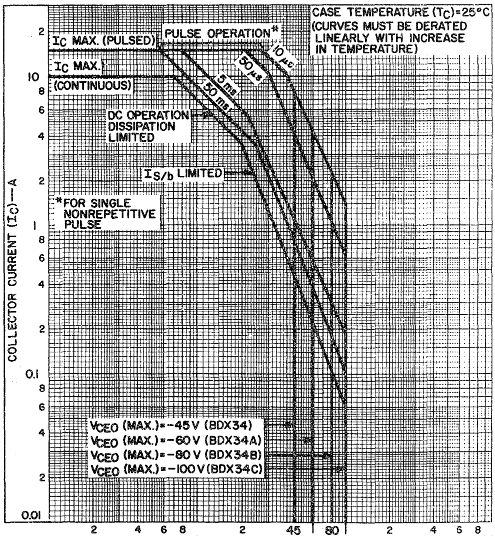
		BDX33 BDX34	BDX33A BDX34A	BDX33B BDX34B	BDX33C BDX34C◆	BDX33D	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	45	60	80	100	120	V
COLLECTOR-TO-EMITTER VOLTAGE:							
With external base-to-emitter resistance (R_{BE}) = 100Ω, sustaining	V_{CER}(sus)	45	60	80	100	120	V
With base open, sustaining	V_{CEO}(sus)	45	60	80	100	120	V
With base reverse-biased $V_{BE} = -1.5$ V	V_{CEX}(sus)	45	60	80	100	120	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	5	5	5	5	V
CONTINUOUS COLLECTOR CURRENT	I_C	10	10	10	10	10	A
CONTINUOUS BASE CURRENT	I_B	0.25	0.25	0.25	0.25	0.25	A
TRANSISTOR DISSIPATION:	P_T						
At case temperatures up to 25°C		70	70	70	70	70	W
At case temperatures above 25°C				Derate linearly 0.56			W/°C
TEMPERATURE RANGE:							
Storage and Operating (Junction)				−65 to + 150			°C
LEAD TEMPERATURE (During Soldering):							
At distances ≥1/8 in. (3.17 mm) from case for 10 s max.				235			°C

◆ For p n p devices, voltage and current values are negative.



92CS-29309

Fig. 1 — Maximum operating areas for BDX33-series types.



92CS-29310

Fig. 2 — Maximum operating areas for BDX34-series types.

BDX33, BDX33A, BDX33B, BDX33C, BDX33D, BDX34, BDX34A, BDX34B, BDX34C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

SYMBOL	TEST CONDITIONS◆					LIMITS										UNITS
	VOLTAGE V dc			CURRENT A dc		BDX33 BDX34◆		BDX33A BDX34A◆		BDX33B BDX34B◆		BDX33C BDX34C◆		BDX33D BDX33D◆		
	V_{CB}	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
I_{CEO} With base open		60			0	–	–	–	–	–	–	–	–	–	0.5	mA
		50			0	–	–	–	–	–	–	–	0.5	–	–	
		40			0	–	–	–	–	–	0.5	–	–	–	–	
		30			0	–	–	–	0.5	–	–	–	–	–	–	
		20			0	–	0.5	–	–	–	–	–	–	–	–	
I_{CEO} T_C = 100°C		60			0	–	–	–	–	–	–	–	–	–	10	
		50			0	–	–	–	–	–	–	–	10	–	–	
		40			0	–	–	–	–	–	10	–	–	–	–	
		30			0	–	–	–	10	–	–	–	–	–	–	
		20			0	–	10	–	–	–	–	–	–	–	–	
I_{CBO}	120					–	–	–	–	–	–	–	–	–	1	
	100					–	–	–	–	–	–	–	1	–	–	
	80					–	–	–	–	–	1	–	–	–	–	
	60					–	–	–	1	–	–	–	–	–	–	
	45					–	1	–	–	–	–	–	–	–	–	
I_{CBO} T_C = 100°C	120					–	–	–	–	–	–	–	5	–	–	
	100					–	–	–	–	–	–	–	–	–	5	
	80					–	–	–	–	–	5	–	–	–	–	
	60					–	–	–	5	–	–	–	–	–	–	
	45					–	5	–	–	–	–	–	–	–	–	
I_{EBO}			–5	0		–	10	–	10	–	10	–	10	–	10	mA
$V_{CEO}(sus)$				0.1^a	0	–	–	–	–	–	–	–	–	120	–	V
				0.1^a	0	–	–	–	–	–	–	100	–	–	–	
				0.1^a	0	45	–	60	–	80	–	–	–	–	–	
$V_{CER}(sus)$ (R_{BE}) = 100Ω				0.1^a		–	–	–	–	–	–	–	–	120	–	
				0.1^a		–	–	–	–	–	–	100	–	–	–	
				0.1^a		45	–	60	–	80	–	–	–	–	–	
$V_{CEV}(sus)$			–1.5	0.1^a		–	–	–	–	–	–	–	–	120	–	
			–1.5	0.1^a		–	–	–	–	–	–	100	–	–	–	
			–1.5	0.1^a		45	–	60	–	80	–	–	–	–	–	
h_{FE}		3		3^a		–	–	–	–	750	–	750	–	750	–	
		3		4^a		750	–	750	–	–	–	–	–	–	–	
V_{BE}		3		3^a		–	–	–	–	–	2.5	–	2.5	–	2.5	V
		3		4^a		–	2.5	–	2.5	–	–	–	–	–	–	
$V_{CE}(sat)$				3^a	0.006	–	–	–	–	–	2.5	–	2.5	–	2.5	V
				4^a	0.008	–	2.5	–	2.5	–	–	–	–	–	–	
V_F				8		–	4	–	4	–	4	–	4	–	4	V
h_{fe} f = 1 kHz		5		1		1000	–	1000	–	1000	–	1000	–	1000	–	
h_{fe} f = 1.0 MHz		5		1		20	–	20	–	20	–	20	–	20	–	
$E_{S/b}{}^b$ R_{BE} = 100Ω L = 12 mH, types BDX33 types			1.5	4.5		120	–	120	–	120	–	120	–	120	–	mJ
L = 3 mH, BDX34 types			1.5	4.5		30	–	30	–	30	–	30	–	30	–	
$I_{S/b}$ tp = 0.5 s nonrep.		25				2.8	–	2.8	–	2.8	–	2.8	–	2.8	–	A
BDX33 types		36				1	–	1	–	1	–	1	–	1	–	
BDX34 types		–20				–3.5	–	–3.5	–	–3.5	–	–3.5	–	–3.5	–	
		–33				–1	–	–1	–	–1	–	–1	–	–1	–	
$R_{\theta JC}$						–	1.78	–	1.78	–	1.78	–	1.78	–	1.78	°C/W

◆ For p-n-p devices, voltage and current values are negative.

[a] Pulsed: Pulse duration = 300 μs, duty factor = 1.8%

[b] $E_{S/b}$ is defined as the energy at which second breakdown occurs under specified reverse bias conditions. $E_{S/b} = 1/2LI^2$ where L is a series load or leakage inductance and I is the peak collector current.

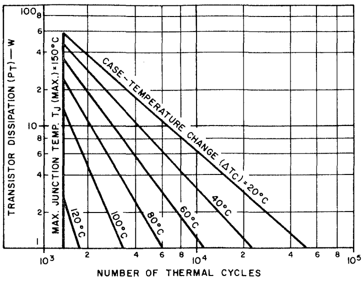


Fig. 3 — Thermal-cycling rating chart for all types.

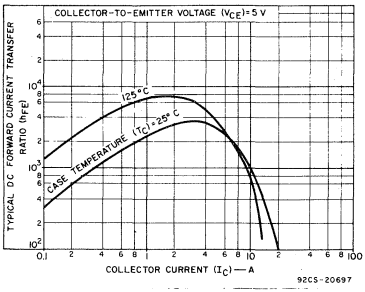


Fig. 4 — Typical dc-beta characteristics for BDX33-series types.

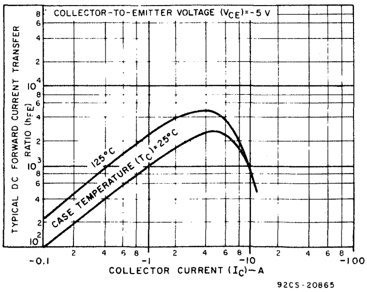


Fig. 5 — Typical dc-beta characteristics for BDX34-series types.

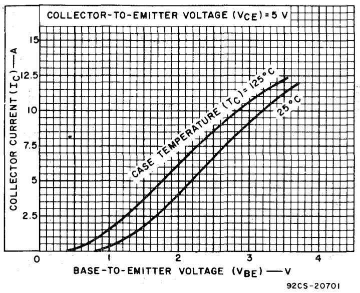


Fig. 6 – Typical transfer characteristics for BDX33-series types.

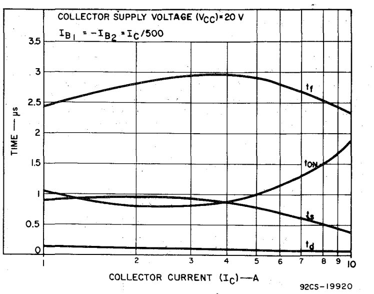


Fig. 7 – Typical saturated switching-time characteristics for BDX33-series types.

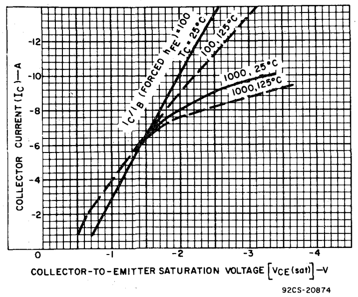


Fig. 8 – Typical saturation characteristics for BDX34-series types.

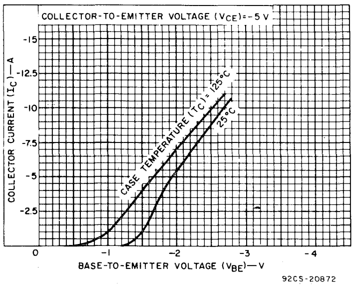


Fig. 9 – Typical transfer characteristics for BDX34-series types.

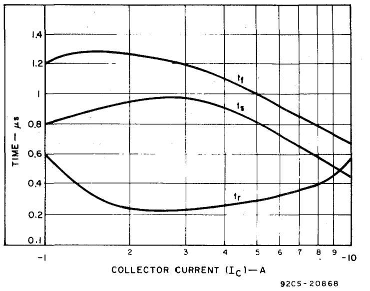


Fig. 10 – Typical saturated switching-time characteristics for BDX34-series types.

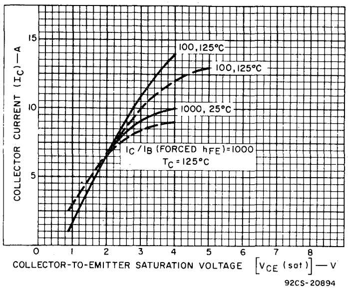


Fig. 11 – Typical saturation characteristics for BDX33-series types.

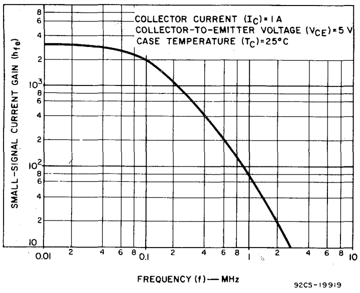


Fig. 12 – Typical small-signal gain for BDX33-series types.

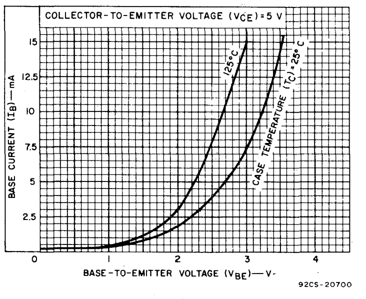


Fig. 13 – Typical input characteristics for BDX33-series types.

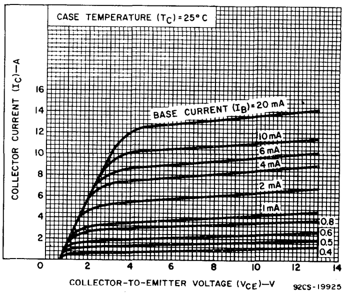


Fig. 14 – Typical output characteristics for BDX33-series types.

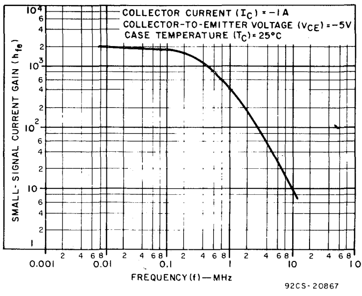


Fig. 15 – Typical small-signal gain for BDX34-series types.

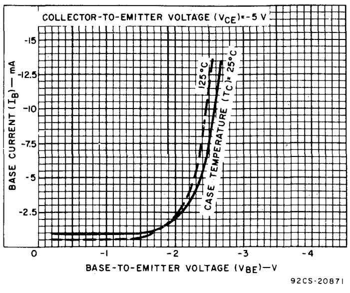


Fig. 16 – Typical input characteristics for BDX34-series types.

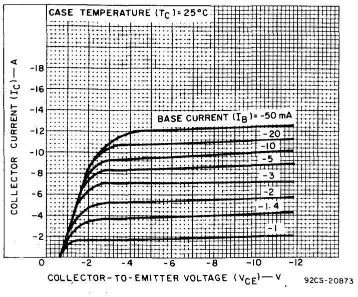


Fig. 17 – Typical output characteristics for BDX34-series types.

BDX83, BDX83A, BDX83B, BDX83C

15-Ampere N-P-N Darlington Power Transistors

40-60-80-100 Volts, 125 Watts   Gain of 1000 at 5 Amperes

Features:
- Operates from IC without predriver
- Low leakage at high temperature
- High reverse second-breakdown capability

Applications:
- Power switching
- Hammer drivers
- Series and shunt regulators
- Audio amplifiers

The RCA-BDX83, BDX83A, BDX83B, and BDX83C are monolithic silicon Darlington transistors designed for low- and medium-frequency power applications. The high gain of these devices makes it possible for them to be driven directly from integrated circuits.

The BDX83-series types are supplied in the JEDEC TO-3 hermetic steel package.

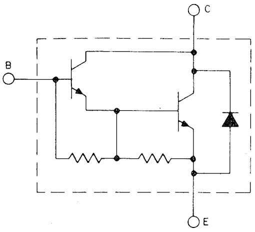
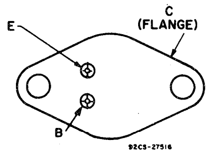


Fig. 1 – Schematic diagram for all types.

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	BDX83	BDX83A	BDX83B	BDX83C	
V_{CBC}	45	60	80	100	V
$V_{CEO}(sus)$	45	60	80	100	V
V_{EBO}	5	5	5	5	V
I_C	10	10	10	10	A
I_{CM}	15	15	15	15	A
I_B	0.25	0.25	0.25	0.25	A
P_T					
$T_C \leqslant 25^oC$	125	125	125	125	W
$T_C > 25^oC$	Derate linearly at 0.714 W/°C				
T_{stg}, T_J	–65 to +200				°C
T_L At distances ⩾ 1/32 in. (0.8 mm) from seating plane for 10 s max.	235				°C

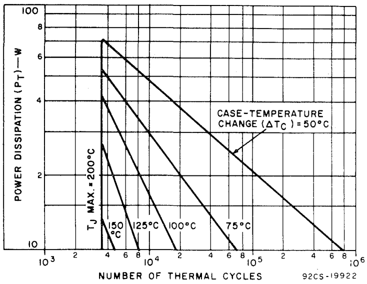


Fig. 3 – Thermal-cycling rating chart for all types.

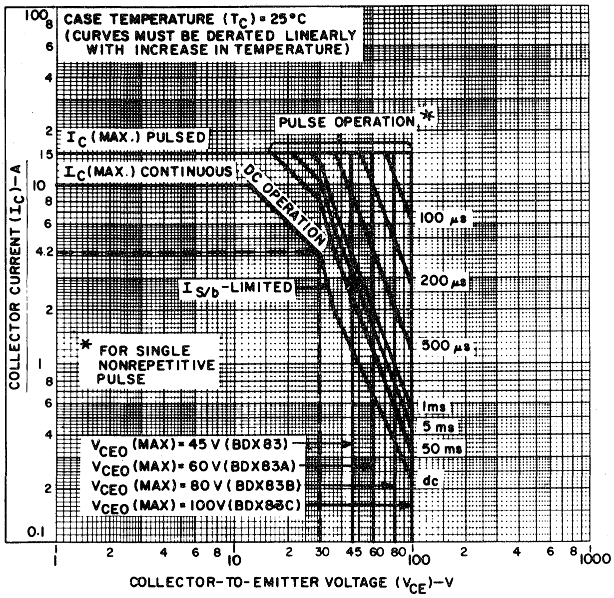


Fig. 2 – Maximum operating area for all types.

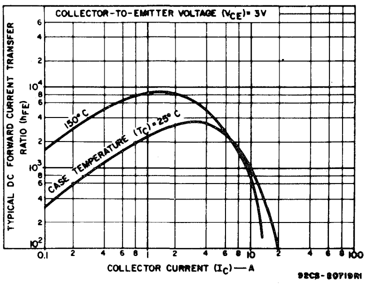


Fig. 4 – Typical dc-beta characteristics for all types.

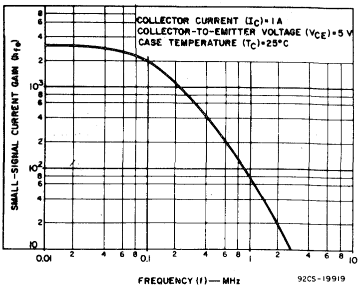


Fig. 5 – Typical small-signal gain for all types.

BDX83, BDX83A, BDX83B, BDX83C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARAC-TERISTIC SYMBOL	TEST CONDITIONS					LIMITS				UNITS
	VOLTAGE V dc			CURRENT A dc		BDX83		BDX83A		
	V_{CE}	V_{EB}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
I_{CEO}	20				0	–	1	–	–	mA
	30				0	–	–	–	1	
I_{CEV}	45		−1.5			–	0.5	–	–	
	60		−1.5			–	–	–	0.5	
T_C = 150°C	45		−1.5			–	3	–	–	
	60		−1.5			–	–	–	3	
I_{EBO}		5		0		–	5	–	5	mA
V_{CEO}(sus)				0.1[a]	0	45	–	60	–	V
h_{FE}	3			1[a]		750	–	750	–	
	3			5[a]		1000	–	1000	–	
	3			10[a]		250	–	250	–	
V_{BE}	3			5[a]		–	2.8	–	2.8	V
	3			10[a]		–	4.5	–	4.5	
V_{CE}(sat)				5[a]	0.01[a]	–	2	–	2	V
V_F				−10		–	4	–	4	
h_{fe} f = 1 kHz	5			1		1000	–	1000	–	
$\|h_{fe}\|$ f = 1 MHz	5			1		20	–	20	–	
$E_{S/b}$[b] L = 12 mH, R_{BE} = 100 Ω			−1.5	4.5		120	–	120	–	mJ
$I_{S/b}$ t = 1 s, non rep.	35					2.2	–	–	–	A
	50					–	–	0.9	–	
	30					4.16	–	4.16	–	
$R_{\theta JC}$						–	1.4	–	1.4	°C/W

[a] Pulsed: Pulse duration = 300 μs, duty factor = 1.8%.

[b] $E_{S/b}$ is defined as the energy at which second breakdown occurs under specified reverse-bias conditions. $E_{S/b}$ = ½LI^2 where L is a series load or leakage inductance, and I is the peak collector current.

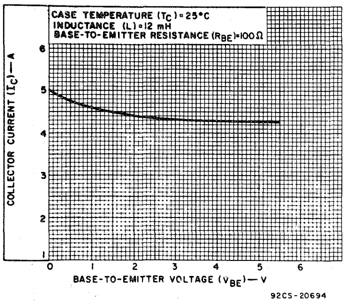


Fig. 6 — Minimum values of reverse-bias second-breakdown characteristic ($E_{S/b}$) for all types.

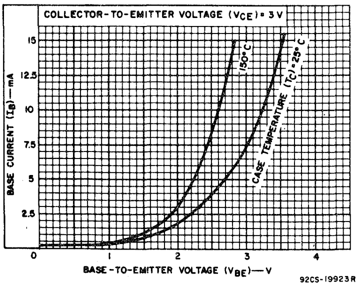


Fig. 7 — Typical input characteristics for all types.

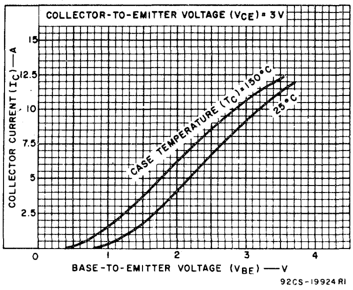


Fig. 8 — Typical transfer characteristics for all types.

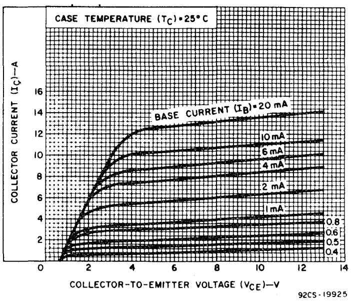


Fig. 9 — Typical output characteristics for all types.

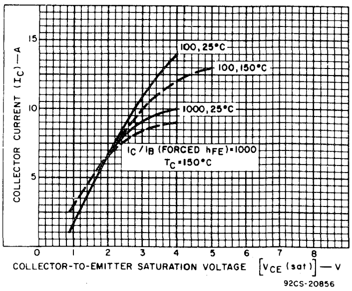


Fig. 10 — Typical saturation characteristics for all types.

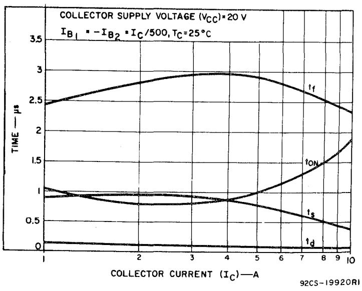


Fig. 11 — Typical saturated switching time characteristics for all types.

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARAC-TERISTIC SYMBOL	TEST CONDITIONS					LIMITS				UNITS
	VOLTAGE V dc			CURRENT A dc		BDX83B		BDX83C		
	V_{CE}	V_{EB}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
I_{CEO}	40				0	–	1	–	–	mA
	50				0	–	–	–	1	
I_{CEV}	80		–1.5			–	0.5	–	–	
	100		–1.5			–	–	–	0.5	
T_C = 150°C	80		–1.5			–	3	–	–	
	100		–1.5			–	–	–	3	
I_{EBO}		5		0		–	5	–	5	mA
$V_{CEO(sus)}$				0.1[a]	0	80	–	100	–	V
h_{FE}	3			1[a]		750	–	750	–	
	3			5[a]		1000	–	1000	–	
	3			10[a]		250	–	250	–	
V_{BE}	3			5[a]		–	2.8	–	2.8	V
	3			10[a]		–	4.5	–	4.5	
$V_{CE(sat)}$				5[a]	0.01[a]	–	2	–	2	V
V_F				–10		–	4	–	4	
h_{fe} f = 1 kHz	5			1		1000	–	1000	–	
$\|h_{fe}\|$ f = 1 MHz	5			1		20	–	20	–	
$E_{S/b}$[b] L = 12 mH, R_{BE} = 100 Ω			–1.5	4.5		120	–	120	–	mJ
$I_{S/b}$ t = 1 s, non rep.	70					0.37	–	–	–	A
	85					–	–	0.25	–	
	30					4.16	–	4.16	–	
$R_{\theta JC}$						–	1.4	–	1.4	°C/W

[a] Pulsed: Pulse duration = 300 µs, duty factor = 1.8%.

[b] $E_{S/b}$ is defined as the energy at which second breakdown occurs under specified reverse-bias conditions. $E_{S/b} = ½LI^2$ where L is a series load or leakage inductance, and I is the peak collector current.

BDY29

Hometaxial-Base, High-Power High-Current Transistor

Rugged Silicon N-P-N Devices for Applications
in Industrial and Commercial Equipment

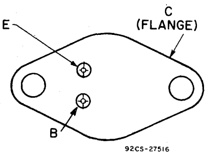
Features:

- **High dissipation capability**
- **High V_{CEX} ratings**
- **15-A specification for h_{FE} and V_{CE}(sat)**
- **Low saturation voltage with high beta**

The RCA-BDY29 is a hometaxial-base silicon, n-p-n transistor intended for a wide variety of high-power high-current applications. Typical applications for the BDY29 include power-switching circuits, audio amplifiers, series- and shunt-regulators, driver and output stages, dc-to-dc converters, inverters, and solenoid (hammer)/relay driver service.

The device is supplied in the popular JEDEC TO-3 package.

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*

COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	100	V
COLLECTOR-TO-EMITTER VOLTAGE:			
With −1.5 V (V_{BE}) & R_{BE} = 100 Ω	V_{CEX}	90	V
With base open	V_{CEO}	75	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	V
CONTINUOUS COLLECTOR CURRENT	I_C	30	A
PEAK COLLECTOR CURRENT	I_{CM}	30	A
CONTINUOUS BASE CURRENT	I_B	7.5	A
TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 25°C		220	W
At case temperatures above 25°C		Derate linearly to 200°C	
TEMPERATURE RANGE:			
Storage & Operating (Junction)		−65 to 200	°C
PIN TEMPERATURE (During soldering):			
At distance ⩾ 1/32 in. (0.8 mm) from seating plane for 10 s max.		230	°C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS					LIMITS		UNITS
		VOLTAGE V dc			CURRENT A dc		BDY29		
		V_{CB}	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	
Collector Cutoff Current: With emitter open	I_{CBO}	100					–	1	mA
With base-emitter junction reverse-biased	I_{CEX}		100	−1.5			–	1	mA
With base-emitter junction reverse-biased & T_C = 150°C	I_{CEX}		100	−1.5			–	10	mA
With base open	I_{CEO}		60			0	–	2	mA
Emitter Cutoff Current	I_{EBO}			−7	0		–	2	mA
DC Forward Current Transfer Ratio	h_{FE}		2		15[a]		15	60	
Collector-to-Emitter Sustaining Voltage: With base-emitter junction reverse-biased (R_{BE})= 100 Ω	V_{CEX}(sus)			−1.5	0.2		90	–	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	V_{CER}(sus)				0.2		85	–	V
With base open	V_{CEO}(sus)				0.2	0	75	–	V
Base-to-Emitter Voltage	V_{BE}		4		30[a]		–	3.5	V
Collector-to-Emitter Saturation Voltage	V_{CE}(sat)				15[a]	1.5	–	1.2	V
Second-Breakdown Collector Current: With base forward-biased and 1-s, nonrepetitive pulse	$I_{S/b}$[b]		60				3.66	–	A
Second-Breakdown Engergy: With base reverse-biased and L = 40 mH, R_{BE} = 100 Ω	$E_{S/b}$[c]			−1.5	5		500	–	mJ
Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio: f = 0.05 MHz	$\|h_{fe}\|$		4		1		4	16 (Typ.)	
Common-Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio: f = 1 kHz	h_{fe}		4		1		40	–	
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$						–	0.8	°C/W

[a] Pulsed; pulse duration = 300 μs, rep. rate = 60 Hz; duty factor ⩽ 2%.

[b] $I_{S/b}$ is defined as the current at which second breakdown occurs at a specified collector voltage with the emitter-base junction forward biased for transistor operation in the active region.

[c] $E_{S/b}$ is defined as the energy at which second breakdown occurs under specified reverse-bias conditions. $E_{S/b} = 1/2LI^2$, where L is a series load or leakage inductance and I is the peak collector current.

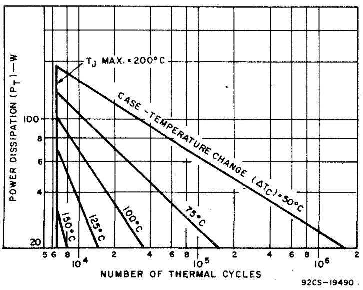


Fig. 1 — Thermal-cycling rating chart.

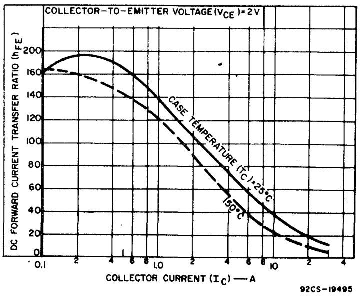


Fig. 2 — Typical dc beta characteristics.

BDY29

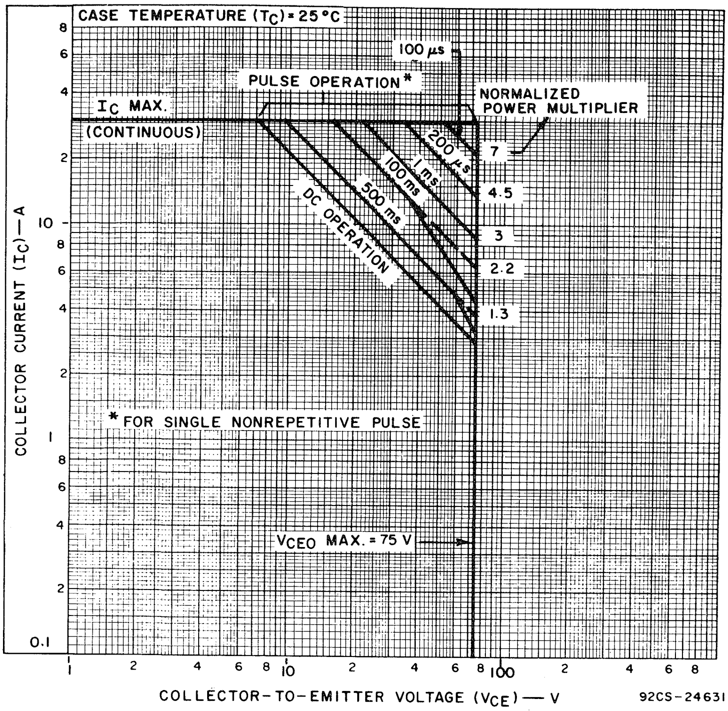


Fig. 3 – Maximum operating areas.

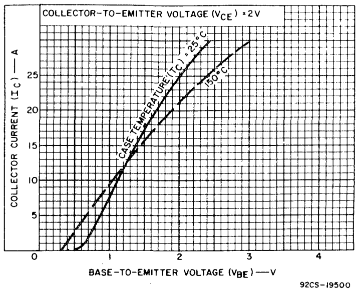


Fig. 4 – Typical transfer characteristics.

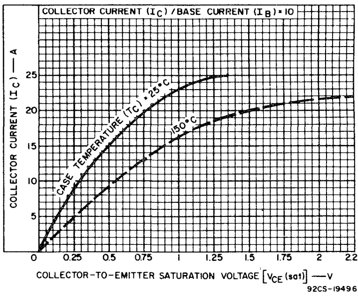


Fig. 5 – Typical saturation-voltage characteristics.

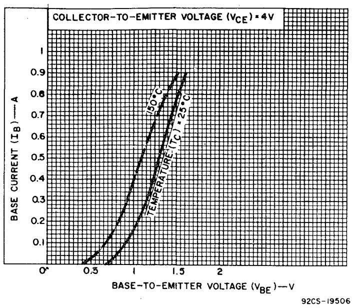


Fig. 6 – Typical input characteristics.

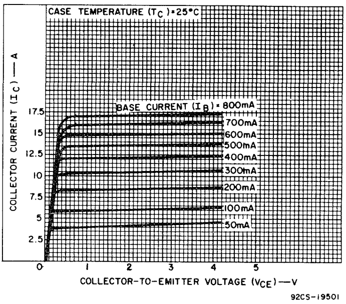


Fig. 7 – Typical output characteristics.

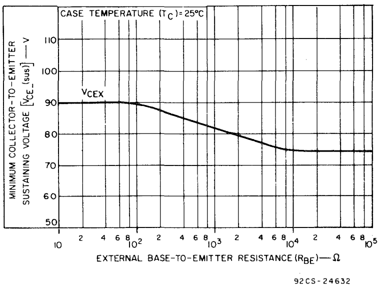


Fig. 8 – Sustaining voltage vs. base-to-emitter resistance.

BDY37

Hometaxial-Base High-Current Silicon N-P-N Transistor

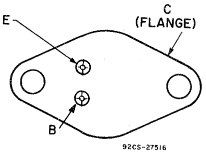
Rugged High-Voltage Device for Applications in Industrial and Commercial Equipment

The RCA-BDY 37 is a hometaxial-base silicon n-p-n transistor intended for a wide variety of high-voltage high-current applications. Typical applications include power-switching circuits, audio amplifiers, series- and shunt-regulator driver and output stages, dc-to-dc converters, inverters, and solenoid (hammer)/relay driver service. The BDY 37 employs the popular JEDEC TO-3 package.

Features:

- **High dissipation capability – 150 W**
- **8-A specification for h_{FE}, V_{BE}, and V_{CE}(sat)**
- **V_{CEX} – 160 V min.**
- **Low saturation voltage with high beta**

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*

COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	160	V
COLLECTOR-TO-EMITTER VOLTAGE:			
With base open	V_{CEO}	140	V
With reverse bias (V_{BE}) of −1.5 V	V_{CEX}	160	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	V
COLLECTOR CURRENT:			
Continuous	I_C	16	A
Peak	I_{CM}	30	A
BASE CURRENT:			
Continuous	I_B	4	A
Peak	I_{BM}	15	A
TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 25°C		150	W
At case temperatures above 25°C		Derate linearly to 200°C	
TEMPERATURE RANGE:			
Storage & Operating (Junction)		−65 to +200	°C
PIN TEMPERATURE (During Soldering):			
At distances ≥1/32 in. (0.8 mm) from case for 10 s max.		230	°C

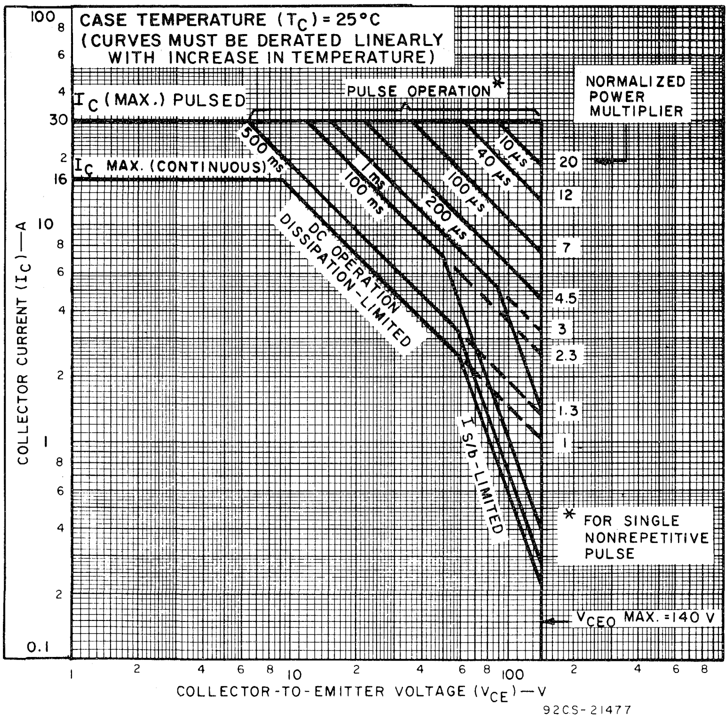


Fig. 1 — Maximum operating areas.

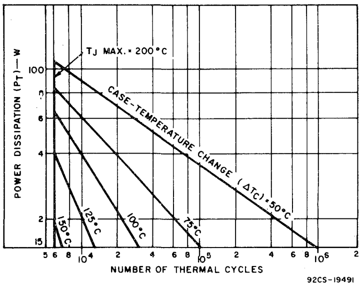


Fig. 2 — Thermal-cycling rating chart.

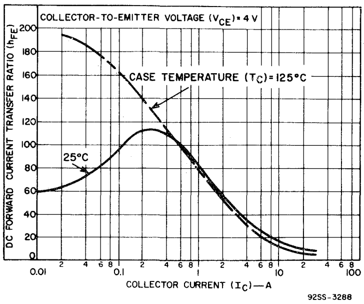


Fig. 3 — Typical dc beta characteristics.

BDY37

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS							LIMITS		UNITS
		VOLTAGE V dc				CURRENT A dc			BDY37		
		V_{CB}	V_{CE}	V_{EB}	V_{BE}	I_C	I_E	I_B	Min.	Max.	
Collector-Cutoff Current: With emitter open	I_{CBO}	140					0		–	2	mA
With base-emitter junction reverse-biased	I_{CEX}		140		−1.5				–	2	mA
With base-emitter junction reverse-biased and T_C = 150°C	I_{CEX}		140		−1.5				–	10	mA
With base open	I_{CEO}		120					0	–	10	mA
Emitter-Cutoff Current	I_{EBO}			7		0			–	5	mA
DC Forward-Current Transfer Ratio	h_{FE}		4			8[a]			15	60	
Collector-to-Emitter Sustaining Voltage: With base-emitter junction reverse-biased (R_{BE} = 100 Ω)	V_{CEX}(sus)				−1.5	0.1			160	–	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	V_{CER}(sus)					0.2[a]			150	–	V
With base open	V_{CEO}(sus)					0.2[a]		0	140	–	V
Base-to-Emitter Voltage	V_{BE}		4			8[a]			–	2.2	V
Collector-to-Emitter Saturation Voltage	V_{CE}(sat)					8[a]		0.8	–	1.4	V
Second-Breakdown Collector Current: With base forward-biased and 1-s nonrepetitive pulse	$I_{S/b}$[b]		60						2.5	–	A
Second-Breakdown Energy: With base reverse-biased and L = 40 mH, R_{BE} = 100 Ω	$E_{S/b}$[c]				−1.5	2.5			0.125	–	J
Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f = 50 kHz)	$\|h_{fe}\|$		4			1			4	–	
Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f = 1 kHz)	h_{fe}		4			1			40	–	
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$								–	1.17	°C/W

[a] Pulsed; pulse duration = 300 µs, rep. rate = 60 Hz, duty factor ⩽ 2%.

[b] $I_{S/b}$ is defined as the current at which second breakdown occurs at a specified collector voltage with the emitter-base junction forward-biased for transistor operation in the active region.

[c] $E_{S/b}$ is defined as the energy at which second breakdown occurs under specified reverse-bias conditions. $E_{S/b} = 1/2LI^2$ where L is a series load or leakage inductance and I is the peak collector current.

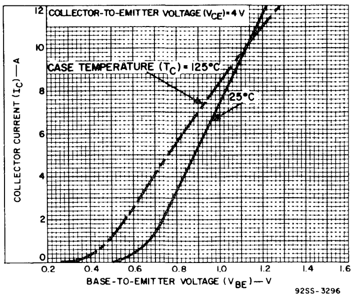


Fig. 4 — Typical transfer characteristics.

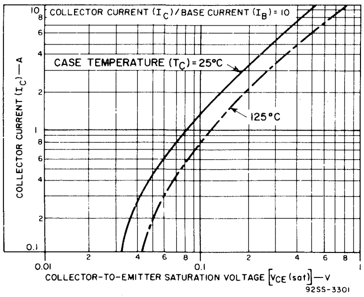


Fig. 5 — Typical staturation-voltage characteristics.

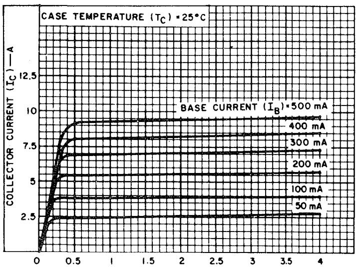


Fig. 6 — Typical output characteristics.

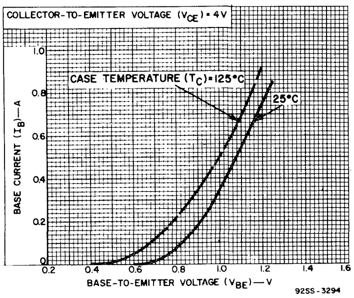


Fig. 7 — Typical input characteristics.

BDY71

Hometaxial-Base, Medium-Power Silicon N-P-N Transistors

For Intermediate-Power Applications in Industrial and Commercial Equipment

The RCA-BDY71 is a hometaxial-base silicon n-p-n transistor intended for a wide variety of medium- to high-power applications. It is supplied in the JEDEC TO-66 hermetic package.

Applications:

- **Power switching circuits**
- **Series- and shunt-regulator driver and output stages**
- **High-fidelity amplifiers**
- **Solenoid drivers**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		BDY71	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	90	V
COLLECTOR-TO-EMITTER VOLTAGE:			
With base open	V_{CEO}	55	V
With external base-to-emitter resistance (R_{BE}) = 100Ω	V_{CER}(sus	60	V
With base reverse-biased (V_{BE} = -1.5 V)	V_{CEV}(sus)	90	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	V
CONTINUOUS COLLECTOR CURRENT	I_C	4	A
CONTINUOUS BASE CURRENT	I_B	2	A
TRANSISTOR DISSIPATION:	P_T		
At case temperature up to 25°C		29	W
At temperatures above 25°C		Derate linearly to 200°C	
TEMPERATURE RANGE:			
Storage & Operating (Junction)		−65 to 200	°C
PIN TEMPERATURE (During Soldering):			
At distance ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max.		235	°C

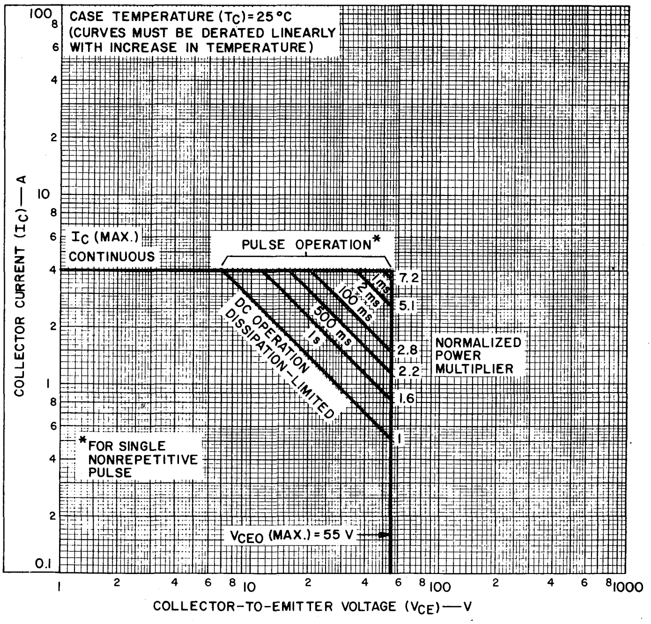
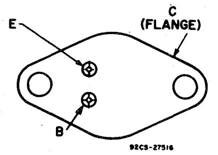


Fig. 1 — Maximum operating areas for BDY71.

Features:

- **Maximum safe-area-of-operation curves for dc and pulse operation**
- **V_{CEV}(sus) = 90 V min**
- **Low saturation voltage: V_{CE}(sat) = 1.0 V at I_C = 0.5 A**

TERMINAL DESIGNATIONS



JEDEC TO-66

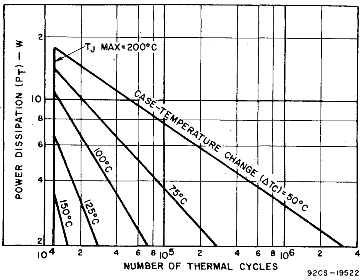


Fig. 2 — Thermal-cycling rating chart.

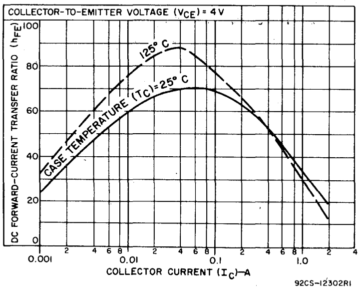


Fig. 3 — Typical dc beta characteristics.

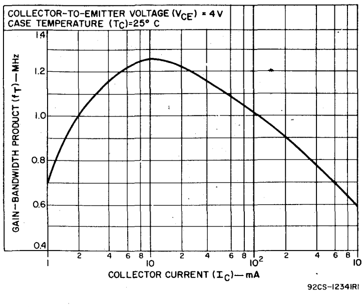


Fig. 4 — Typical gain-bandwidth product.

BDY71

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS		UNITS
		VOLTAGE V dc		CURRENT A dc		BDY71		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	
Collector-Cutoff Current: With base open	I_{CEO}	30			0	–	0.5	mA
With base-emitter junction reverse-biased	I_{CEX}	90	−1.5			–	1	mA
at T_C = 150°C	I_{CEX}	90	−1.5			–	6	mA
Emitter-Cutoff Current	I_{EBO}		−7		0	–	1	mA
Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$			0.1[a]	0	55	–	V
With external base-to-emitter resistance (R_{BE}) = 100Ω	$V_{CER}(sus)$			0.1[a]		60	–	V
DC Forward-Current Transfer Ratio	h_{FE}	4 4		3[a] 0.5[a]		5 80	– 200	
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$			0.5[a] 3[a]	0.05[a] 1[a]	– –	1 6	V
Base-to-Emitter Voltage	V_{BE}	4		0.5		–	1.7	V
Common-Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio Cutoff Frequency	f_{hfe}	4		0.1		0.03	–	MHz
Gain-Bandwidth Product: f = 0.4 MHz	f_T			0.2		800	–	kHz
Common-Emitter, Small-Signal, Short-Circuit Forward Current Transfer Ratio: f = 1 kHz	h_{fe}	4		0.1		25	–	
Forward-Bias Second Breakdown Collector Current: t = 1-s nonrepetitive	$I_{S/b}$	55				525	–	mA
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$					6.3	–	°C/W

[a] Pulsed: Pulse duration = 300 μs, duty factor = 1.8%.

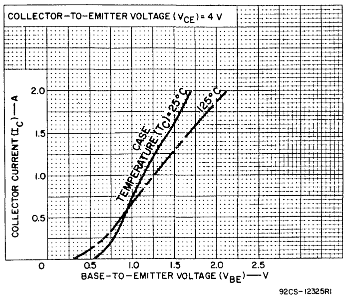


Fig. 5 — Typical transfer characteristics.

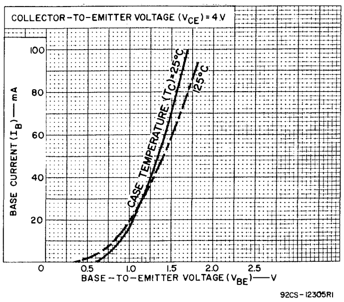


Fig. 6 — Typical input characteristics.

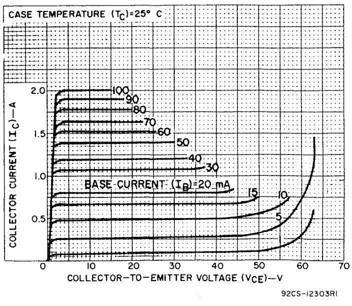


Fig. 7 — Typical output characteristics.

BFT19, BFT19A, BFT19B

High-Voltage Silicon P-N-P Transistors

For High-Speed Switching and Linear-Amplifier Applications in Military, Industrial and Commercial Equipment

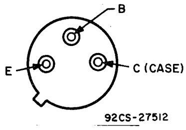
Features:

- **Maximum safe-area-of-operation curves**
- **High voltage ratings:**
  V_{CBO} = -400 V max. (BFT19B); -300 V max. (BFT19A); -200 V max. (BFT19)
  V_{CEO}(sus) = -350 V max. (BFT19B); -250 V max. (BFT19A); -150 V max. (BFT19)

RCA-BFT19, BFT19A, and BFT19B are silicon p-n-p transistors with high breakdown voltages, high frequency response, and fast switching speeds. These transistors differ in their voltage ratings. They are supplied in the JEDEC TO-39 hermetic package.

Typical applications include high-voltage differential and operational amplifiers; high-voltage inverters, and high-voltage, low-current switching and series regulators.

TERMINAL DESIGNATIONS



JEDEC TO-39

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		BFT19	BFT19A	BFT19B	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	-200	-300	-400	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:					
With base open	V_{CEO}(sus)	-150	-250	-350	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	V_{CER}(sus)	-200	-300	-400	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	-5	-5	-5	V
COLLECTOR CURRENT (Continuous)	I_C	-1	-1	-1	A
BASE CURRENT (Continuous)	I_B	-0.5	-0.5	-0.5	A
TRANSISTOR DISSIPATION:	P_T				
At case temperatures up to 25°C		5	5	5	W
At case temperatures above 25°C		Derate linearly to 200°C			
At ambient temperatures up to 25°C		1	1	1	W
At ambient temperatures above 25°C		Derate linearly at 5.7 mW/°C			
TEMPERATURE RANGE:					
Storage and Operating (Junction)		← -65 to 200 →			°C
PIN TEMPERATURE (During Soldering):					
At distance ⩾ 1/32 in. (0.8 mm) from case for 10 s max.		← 255 →			°C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS						LIMITS						UNITS
		VOLTAGE V dc			CURRENT mA			BFT19		BFT19A		BFT19B		
		V_{CB}	V_{CE}	V_{EB}	I_C	I_E	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
Collector-Cutoff Current: With emitter open	I_{CBO}	-100 -200 -300					0 0 0	– – –	-100 – –	– – –	– -100 –	– – –	– – -100	μA
Emitter-Cutoff Current	I_{EBO}			-5	0			–	-100	–	-100	–	-100	μA
DC Forward-Current Transfer Ratio	h_{FE}		-10 -10 -10		-10 -30 -50			20 25 20	– – –	20 25 20	– – –	20 25 20	– – –	
Collector-to-Emitter Sustaining Voltage With base open	V_{CEO}(sus)				-10		0	-150[a]	–	-250[a]	–	-350[a]	–	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	V_{CER}(sus)				-10			-200[a]	–	-300[a]	–	-400[a]	–	V
Base-to-Emitter Saturation Voltage	V_{BE}(sat)				-30		-3	–	-1.8	–	-1.8	–	-1.8	V
Collector-to-Emitter Saturation Voltage	V_{CE}(sat)				-10 -30		-1 -3	– –	-1 -2.5	– –	-1 -2.5	– –	-1 -2.5	V
Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (at 1 kHz)	h_{fe}		-10		-5			25	–	25	–	25	–	
Magnitude of Common-Emitter, Small-Signal, Short-Circuit Forward-Current Transfer Ratio (at 5 MHz)	$\|h_{fe}\|$		-10		-30			5	–	5	–	5	–	
Common-Base, Short-Circuit, Input Capacitance (at 1 MHz)	C_{ib}			-5	0			–	75	–	75	–	75	pF
Output Capacitance (at 1 MHz)	C_{ob}	-10				0		–	15	–	15	–	15	pF
Second-Breakdown Collector Current: With base forward biased	$I_{S/b}$	-100						-50	–	-50	–	-50	–	mA
Thermal Resistance: (Junction-to-Case)	$R_{\theta JC}$							–	35	–	35	–	35	°C/W

[a] CAUTION: The sustaining voltages V_{CEO}(sus) and V_{CER}(sus) MUST NOT be measured on a curve tracer.

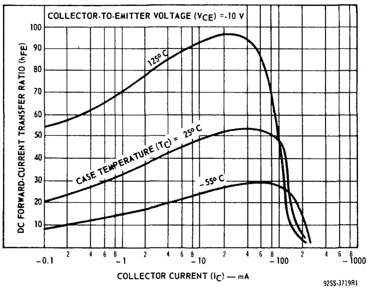


Fig. 1 — Typical dc beta characteristics.

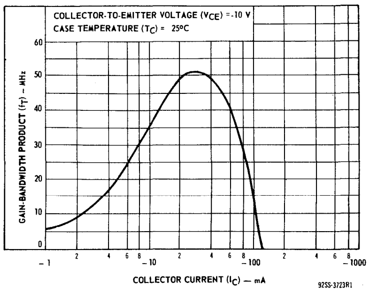


Fig. 2 — Typical gain-bandwidth product.

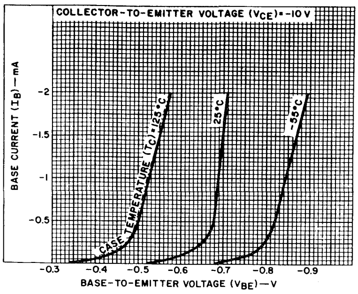


Fig. 3 — Typical input characteristics.

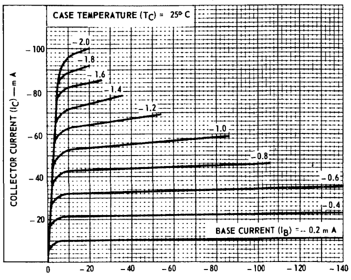


Fig. 4 — Typical output characteristics.

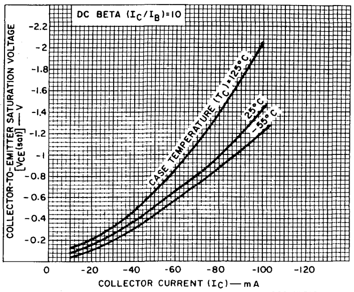


Fig. 5 — Typical collector-to-emitter saturation voltage.

BFT19, BFT19A, BFT19B

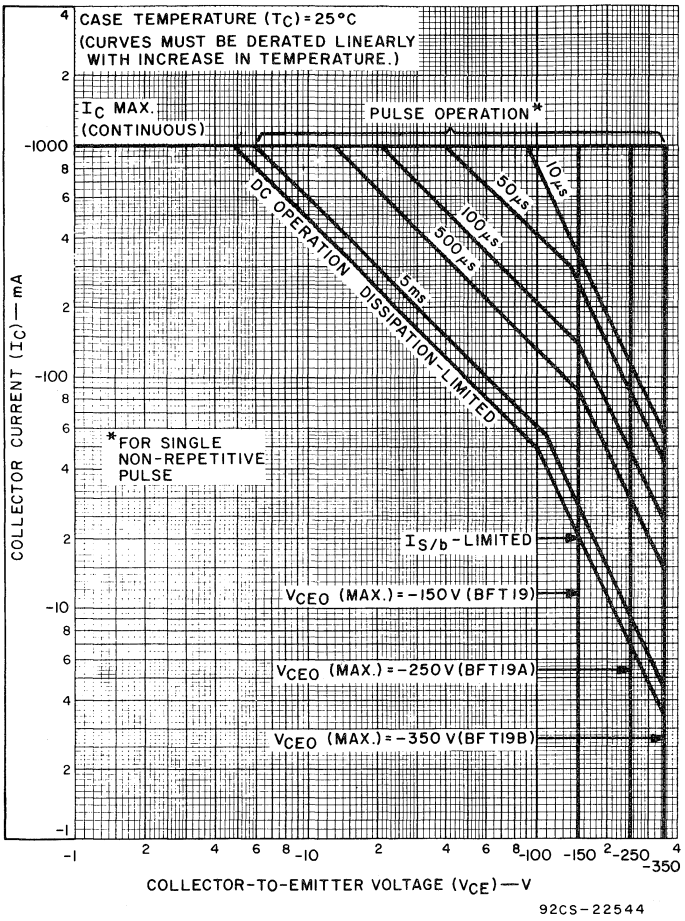


Fig. 6 — Maximum operating areas for all types.

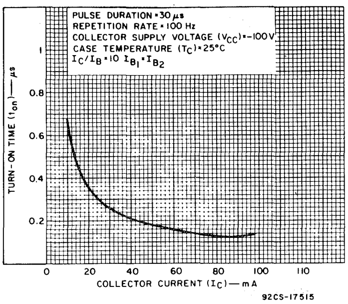


Fig. 7 — Typical turn-on time characteristics.

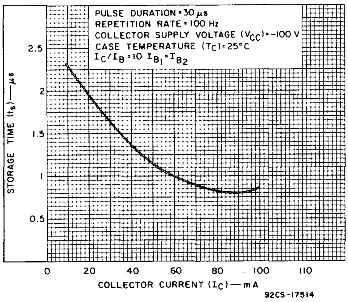


Fig. 8 — Typical storage-time characteristic.

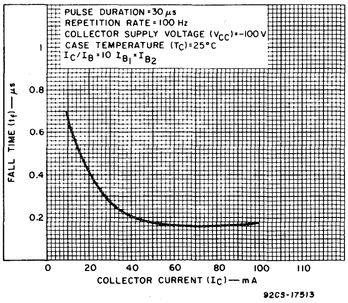


Fig. 10 — Typical fall-time characteristic.

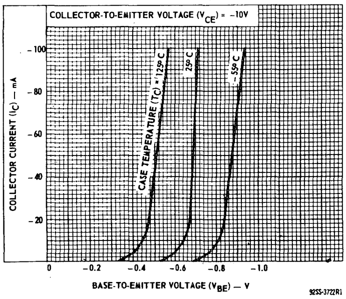


Fig. 9 — Typical transfer characteristics.

BFT28, BFT28A, BFT28B, BFT28C,

High-Voltage Silicon P-N-P Transistors

For High-Speed Switching and Linear-Amplifier
Applications in Military, Industrial and Commercial Equipment

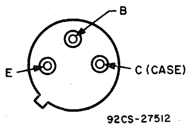
The RCA-BFT28, BFT28A, BFT28B and BFT28C are silicon p-n-p transistors with high breakdown voltages, high frequency response, and fast switching speeds. They are supplied in the JEDEC TO-39 hermetic package.

These transistors differ primarily in their voltage ratings. Typical applications include high-voltage differential and operational amplifiers; high-voltage inverters; and high-voltage, low-current switching and series regulators.

Features:

- **Maximum safe-area-of-operation curves**
- **High voltage ratings:**
  V_{CBO} = −150 V max. (BFT 28); −200 V max. (BFT28A); −250 V max. (BFT 28 B); −300 V max. (BFT28C)
  $V_{CEO(sus)}$ = −100 V max. (BFT 28); −150 V max. (BFT28A); −200 V max. (BFT28B); −250 V max. (BFT28C)

TERMINAL DESIGNATIONS



JEDEC TO-39

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		BFT28	BFT28A	BFT28B	BFT28C	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	−150	−200	−250	−300	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:						
With external base-to-emitter resistance (R_{BE}) = 100 Ω	$V_{CER}(sus)$	−150	−200	−250	−300	V
With base open	$V_{CEO}(sus)$	−100	−150	−200	−250	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	−4	−4	−4	−4	V
COLLECTOR CURRENT	I_C	−1	−1	−1	−1	A
BASE CURRENT	I_B	−0.5	−0.5	−0.5	−0.5	A
TRANSISTOR DISSIPATION:						
At case temperatures up to 25°C		5	5	5	5	W
At case temperatures above 25°C		Derate linearly to 200°C				
At ambient temperatures up to 50°C		1	1	1	1	W
At ambient temperatures above 50°C ..... Derate linearly at		5.7	5.7	5.7	5.7	mW/°C
TEMPERATURE RANGE:						
Storage and Operating (Junction)		−65 to +200				°C
LEAD TEMPERATURE (During soldering):						
At distance ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max.		255				°C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS					LIMITS								UNITS
		VOLTAGE V dc			CURRENT mA dc		BFT28		BFT28A		BFT28B		BFT28C		
		V_{CB}	V_{CE}	V_{EB}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Collector-Cutoff Current: With emitter open	I_{CBO}	−50 −75 −150					– – –	−1 – –	– – –	– −1 –	– – –	– – −5	– – –	– – −5	µA
Emitter-Cutoff Current	I_{EBO}			−4	0		–	−100	–	−100	–	−100	–	−100	µA
DC Forward-Current Transfer Ratio	h_{FE}		−10		−10[c]		20	–	20	–	20	–	20	–	
Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$				−10	0	−100[a]	–	−150[a]	–	−200[a]	–	−250[a]	–	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	$V_{CER}(sus)$				−10		−150[a]	–	−200[a]	–	−250[a]	–	−300[a]	–	V
Base-to-Emitter Saturation Voltage	$V_{BE}(sat)$				−30[c]	−3	–	−1.5	–	−1.5	–	−1.5	–	−1.5	V
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$				−10[c]	−1	–	−0.6	–	−0.6	–	−5	–	−5	V
Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio: f = 1 kHz	h_{fe}		−10		−5		25	–	25	–	25	–	25	–	
Magnitude of Common-Emitter, Small-Signal, Short-Circuit Forward-Current Transfer Ratio: f = 5 MHz	$\lvert h_{fe}\rvert$		−10		−30		5	–	5	–	5	–	5	–	
Common-Base, Short-Circuit, Input Capacitance: f = 1 MHz	C_{ib}			−5	0		–	75	–	75	–	75	–	75	pF
Output Capacitance: f = 1 MHz	C_{ob}	−10					–	15	–	15	–	15	–	15	pF
Forward-Bias, Second-Breakdown Collector Current: 0.4-s non-repetitive pulse	$I_{S/b}$[b]		−80				−62.5	–	−62.5	–	−62.5	–	−62.5	–	mA
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$						–	35	–	35	–	35	–	35	°C/W

[a] CAUTION: The sustaining voltages $V_{CEO}(sus)$ and $V_{CER}(sus)$ MUST NOT be measured on a curve tracer.

[b] $I_{S/b}$ is defined as the current at which second breakdown occurs at a specified collector voltage.

[c] Pulsed, pulse duration = 300 µs; duty factor ≤ 2%.

BFT28, BFT28A, BFT28B, BFT28C

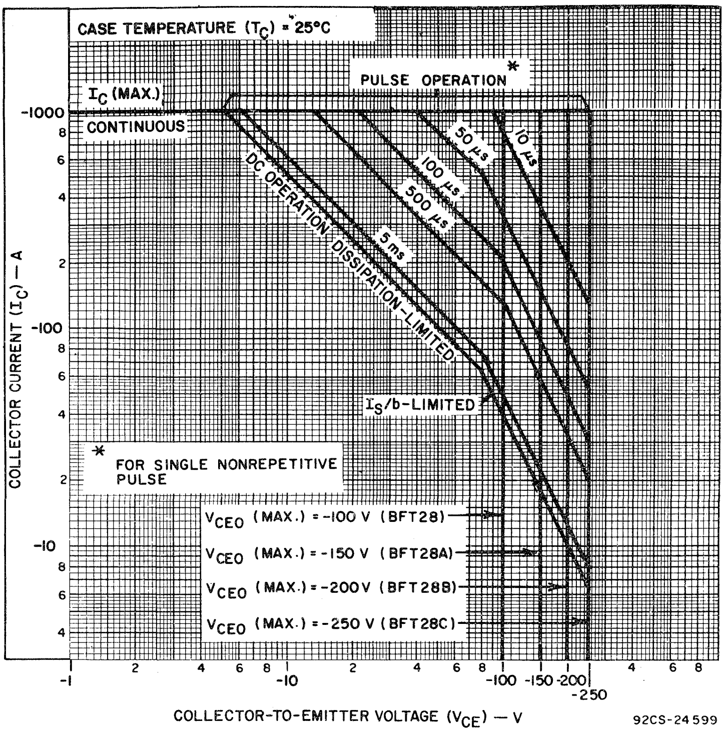


Fig. 1 — Maximum safe operating areas.

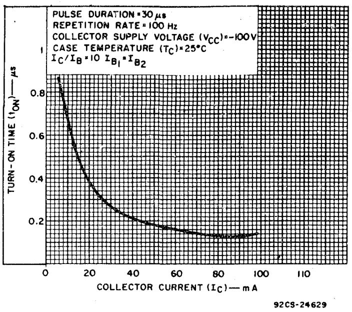


Fig. 2 — Typical turn-on time characteristic for all types.

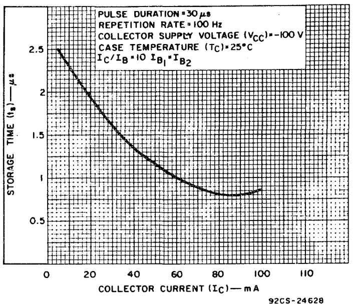


Fig. 3 — Typical storage-time characteristic for all types.

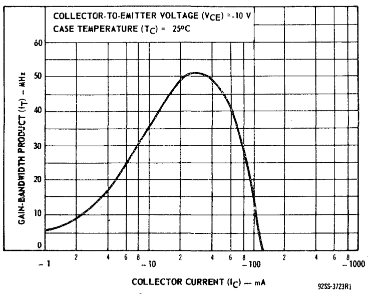


Fig. 4 — Typical gain-bandwidth product for all types.

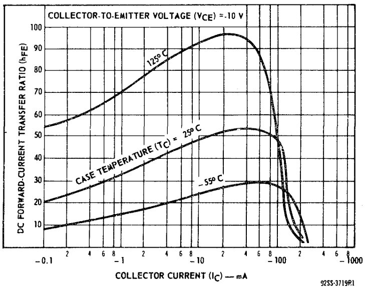


Fig. 5 — Typical dc beta characteristics for all types.

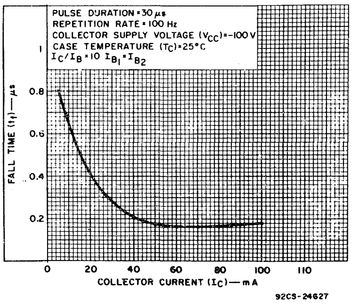


Fig. 6 — Typical fall-time characteristic for all types.

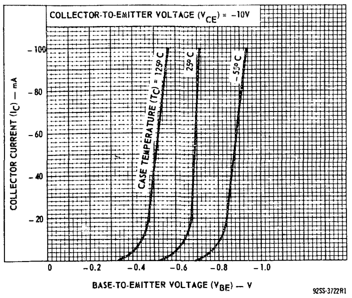


Fig. 7 — Typical transfer characteristics for all types.

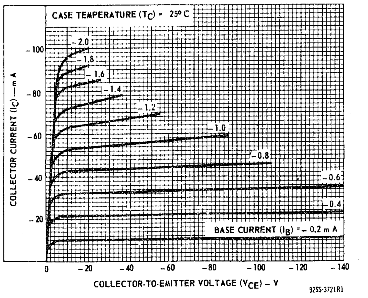


Fig. 8 — Typical output characteristics for all types.

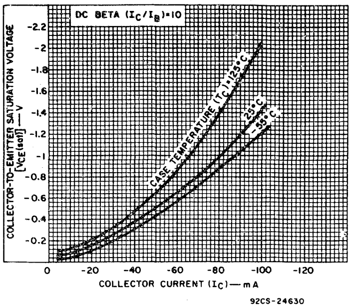


Fig. 9 — Typical collector-to-emitter saturation voltage for all types.

BU106

Epitaxial-Base Silicon N-P-N Transistor

For Horizontal Deflection for Small-Screen
Black-and-White TV

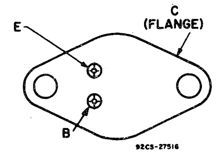
Features:

- **Maximum safe-area-of-operation curves**
- **Low saturation voltages**
- **High voltage ratings**
- **High dissipation rating**

BU106 is a silicon n-p-n transistor with a pi-nu epitaxial-layer construction. This device is supplied in a JEDEC TO-3 hermetic package. The BU106 is primarily intended for use in horizontal-deflection output stages in small-screen black-and-white television receivers.

This transistor is supplied in the JEDEC TO-3 hermetic package.

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*

COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	325	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:			
With base open	V_{CEO}(sus)	140	V
With base reverse-biased (V_{BE}) between −2 V ~ 8 V	V_{CEV}(sus)	325	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	8	V
CONTINUOUS COLLECTOR CURRENT	I_C	7	A
PEAK COLLECTOR CURRENT		10	A
CONTINUOUS BASE CURRENT	I_B	4	A
TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 25°C and V_{CE} up to 40 V		75	W
At case temperatures up to 25°C and V_{CE} above 40 V		See Fig. 3	
At case temperatures above 25°C		Derate linearly to 200°C	
TEMPERATURE RANGE:			
Storage and Operating (Junction)		−65 to +200	°C
PIN TEMPERATURE (During Soldering):			
At distances ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max. .		230	°C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

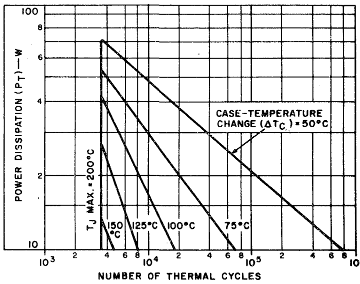
CHARACTERISTIC	SYMBOL	TEST CONDITIONS						LIMITS		UNITS
		VOLTAGE V dc			CURRENT A dc			BU106		
		V_{CE}	V_{EB}	V_{BE}	I_C	I_B	I_E	MIN.	MAX.	
Collector Cutoff Current: With base open	I_{CEO}	100				0		–	2	mA
With base-emitter junction reverse-biased	I_{CEV}	325		−1.5				–	2	
With base-emitter junction reverse-biased and T_C = 100°C		325		−1.5				–	5	
Emitter-Cutoff Current	I_{EBO}		8		0			–	10	mA
Collector-to-Emitter Sustaining Voltage (See Figs. 4 and 5): With base open	V_{CEO}(sus)				0.1^a	0		140	–	V
With base-emitter junction reverse-biased	V_{CEV}(sus)			−2	0.05^a			325	–	
Emitter-to-Base Voltage	V_{EBO}				0.01			8	–	V
DC Forward-Current Transfer Ratio	h_{FE}	5			4^a			8	–	
Base-to-Emitter Saturation Voltage	V_{BE}(sat)				4^a	0.5		–	1.5	V
Collector-to-Emitter Saturation Voltage	V_{CE}(sat)				4^a	0.5		–	5	V
Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio (f = 1 MHz)	$\|h_{fe}\|$	10			0.2			3	–	
Common Base Output Capacitance (f = 1 MHz)	C_{ob}	V_{CB} = 10					0	150	–	pF
Forward-Bias Second Break-down Collector Current (1-s non-repetitive pulse)	$I_{S/b}$	40						1.85	–	A
Switching Time: Storage (V_{CC} = 40 V)	t_s				4	0.5^c		–	3	μs
Turn-off (V_{CC} = 40 V)	t_{OFF}	2			0.1			–	1.5	
Thermal Resistance Junction-to-Case	$R_{\theta JC}$	10			5			–	2.34	°C/W

[a] Pulsed; pulse duration ≤ 350 μs, Duty factor = 2%.

[b] CAUTION: The sustaining voltages V_{CEO}(sus), and V_{CEV}(sus), MUST NOT be measured on a curve tracer.

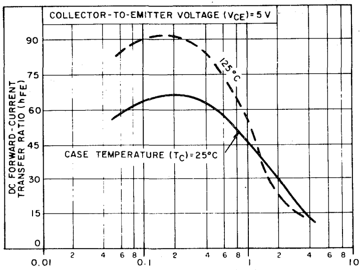
[c] $I_{B1} = I_{B2}$ = value shown.

[d] Turn-off is measured when V_{CE} has reached a value of 2 V and I_C has decreased to 100 mA.



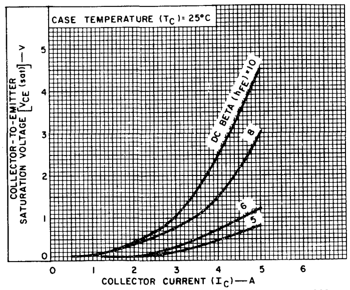
92CS-19922

Fig. 1 — Thermal-cycling rating chart.



92CS-22795

Fig. 2 — Typical dc beta characteristics.



92CS-19028

Fig. 3 — Typical saturation voltage characteristics.

BU106

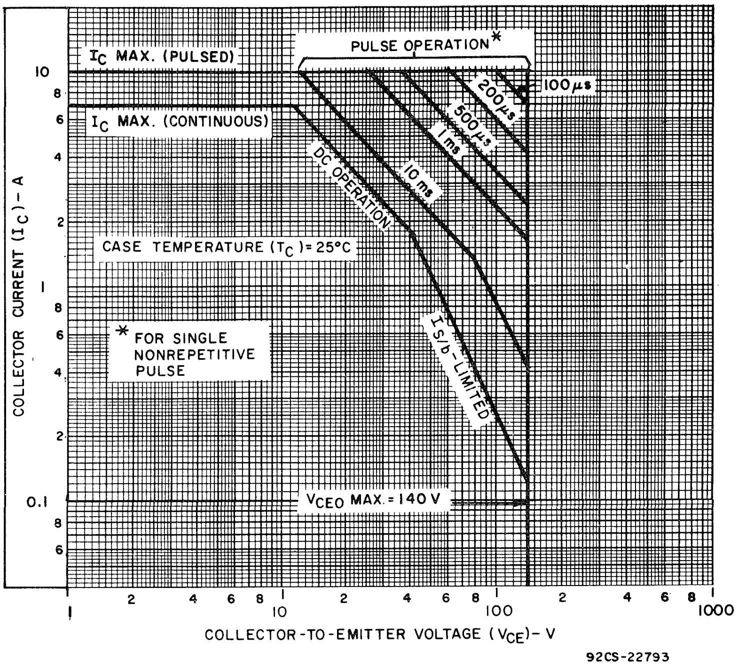


Fig. 4 — Maximum operating areas.

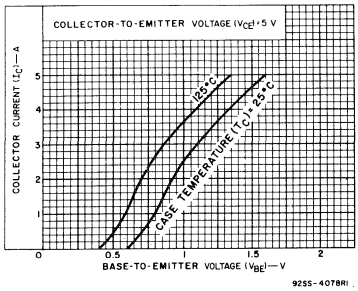


Fig. 5 — Typical transfer characteristics.

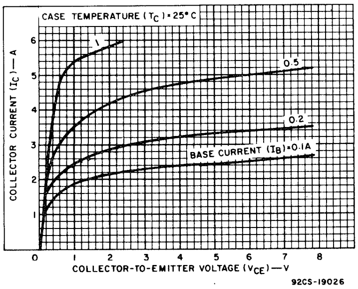


Fig. 6 — Typical output characteristics.

BU126, BU133

High-Voltage, Power-Switching Silicon N-P-N Transistors

TV Colour/Monochrome Receiver Power Supplies –90° and 110° Deflection Angles

The RCA-BU126 and BU133 are silicon epitaxial-collector n-p-n power switching transistors intended for use in switched-mode power supplies of 90° and 110° colour and black-and-white TV receivers.

These devices are hermetically sealed in a steel JEDEC TO-3 package.

Features:

- **Fast switching speed**
- **Hermetic steel package – JEDEC TO-3**
- **Epitaxial pi-nu construction**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	BU126	BU133	
V_{CES}	750	750	V
V_{CEV}			
$V_{BE} = -1.5$ V	750	750	V
$V_{CEO}(sus)$	300	250	V
V_{EBO}	6	6	V
I_C	3	3	A
I_{CM}	6	6	A
I_B	2	2	A
P_T			
Up to 25°C	80	80	W
Above 25°C	Derate linearly to 200°C		
T_J, T_{stg}	–65 to 200		°C
T_L			
At distances ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max.	235		°C

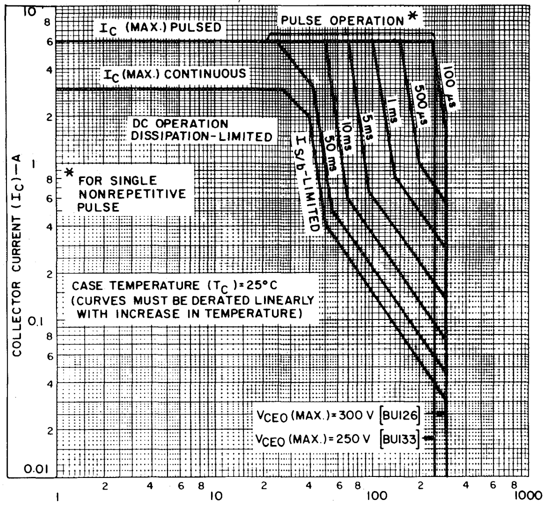


Fig. 1 — Maximum operating areas for BU126, BU133.

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

SYMBOL	TEST CONDITIONS				LIMITS				UNITS
	VOLTAGE V dc		CURRENT A dc		BU126		BU133		
	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
I_{CES}	750	0			–	500	–	500	µA
$T_C = 125°C$	750	0			–	2	–	2	mA
I_{EBO}		–6			–	5	–	5	mA
h_{FE}	5		1a		15	60	15	80	
$V_{CEO}(sus)$			0.1^a	0	300^b	–	250^b	–	V
$V_{BE}(sat)$			4^a	1	–	1.5	–	1.5	V
$V_{CE}(sat)$			2.5^a 4^a	0.25 1	– –	10 5	– –	10 5	V
$I_{S/b}$ t = 1 s nonrep.	40 200				2 50	– –	2 50	– –	V mA
f_T	10		0.2		3.5 typ.		3.5 typ.		MHz
t_s $V_{CC} = 50$ V			2.5	0.25^c	1.5 typ.	2.4	1.5 typ.	2.4	µs
t_f $V_{CC} = 50$ V^d			2.5	0.25^c	0.5 typ.	0.9	0.5 typ.	0.9	µs
$R_{\theta JC}$					–	2.18	–	2.18	°C/W

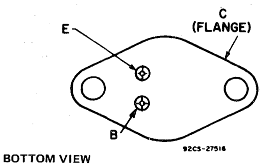
[a] Pulsed: pulse duration = 300 µs, rep. rate = 50 Hz, duty factor = 2%

[b] CAUTION: The sustaining voltage $V_{CEO}(sus)$ MUST NOT be measured on a curve tracer.

[c] $I_{B1} = I_{B2}$

[d] Fall-time characteristics measured in a typical switched-mode power supply show an average value of 0.16 µs.

TERMINAL DESIGNATIONS



JEDEC TO-3

BUX16, BUX16A, BUX16B, BUX16C

High-Voltage, High-Power Silicon N-P-N Power Transistor

For Switching and Linear Applications in
Industrial, and Commercial Equipment

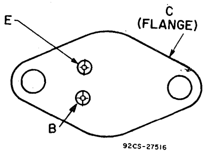
Features:

- **High voltage ratings: V_{CER}(sus) up to 400 V, $R_{BE} \leqslant 50\ \Omega$**
  V_{CEO}(sus) up to 350 V
- **High power dissipation rating: P_T = 100 W at V_{CE} = 135 V, T_C = 25°**
- **For switching applications where circuit values and operating conditions require a transistor with a high second breakdown rating ($I_{S/b}$) (limit line begins at 135 V)**
- **Maximum area-of-operation curves for dc and pulse operation**

The RCA BUX16-series devices are multiple epitaxial silicon n-p-n power transistors employing a new overlay construction with several emitter sites. All devices employ the popular JEDEC TO-3 package; they differ in breakdown-voltage, leakage-current, and current-gain values.

The high breakdown-voltage ratings and exceptional second-breakdown capabilities of these transistors make them especially suitable for use in series regulators, power amplifiers, inverters, deflection circuits, switching regulators, and high-voltage bridge amplifiers.

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		BUX16	BUX16A	BUX16B	BUX16C	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	250	325	375	425	V
COLLECTOR-TO-EMITTER VOLTAGE:						
With base reverse-biased (V_{BE}) = −1.5 V	V_{CEV}	250	325	375	425	V
With external base-to-emitter resistance (R_{BE}) $\leqslant$50 Ω	V_{CER}(sus)	225	300	350	400	V
With base open	V_{CEO}(sus)	200	250	300	350	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	6	6	6	6	V
CONTINUOUS COLLECTOR CURRENT	I_C	5	5	5	5	A
CONTINUOUS BASE CURRENT	I_B	2	2	2	2	A
TRANSISTOR DISSIPATION:						
At case temperatures up to 25°C and V_{CE} up to 135 V		100	100	100	100	W
At case temperatures up to 25°C and V_{CE} above 135 V		See Fig. 1				
At case temperatures above 25°C		Derate linearly to 200°C				
TEMPERATURE RANGE:						
Storage and operating (Junction)		−65 to 200				°C
PIN TEMPERATURE (During soldering):						
At distance $\geqslant$ 1/32 in. (0.8 mm) from seating plane for 10 s max.	T_P	230				°C

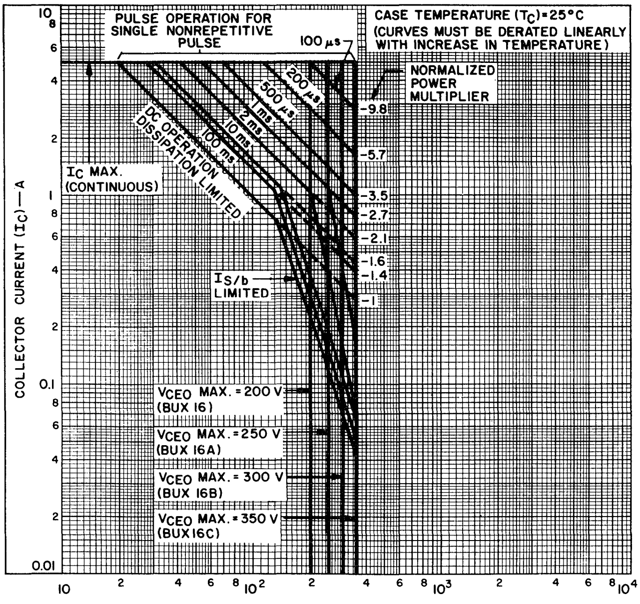


Fig. 1 — Maximum operating areas for all types.

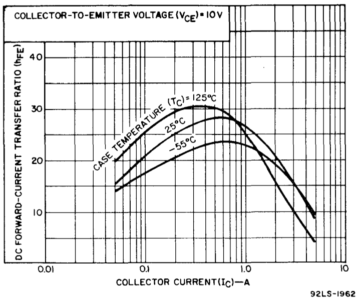


Fig. 2 — Typical dc beta vs. collector current for all types.

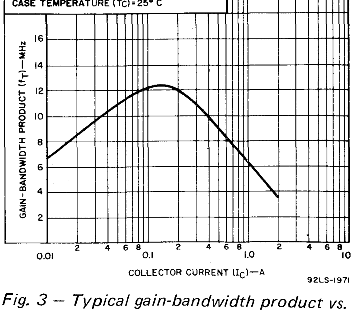


Fig. 3 — Typical gain-bandwidth product vs. collector current for all types.

BUX16, BUX16A, BUX16B, BUX16C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS								UNITS
		VOLTAGE V dc		CURRENT A dc		BUX16		BUX16A		BUX16B		BUX16C		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Collector Cutoff Current: With base reverse-biased	I_{CEV}	250 325 375 425	−1.5 −1.5 −1.5 −1.5	– – – –	– – – –	– – – –	5 – – –	– – – –	– 5 – –	– – – –	– – 2 –	– – – –	– – – 2	mA
With base reverse-biased T_C = 150°C	I_{CEV}	250	−1.5	–	–	–	8	–	8	–	3	–	3	
With base open	I_{CEO}	175 250	– –	– –	0 0	– –	5 –	– –	2 –	– –	– 5	– –	– 2	
Emitter Cutoff Current: V_{EB} = 5 V	I_{EBO}	–	–	0	–	–	5	–	5	–	2	–	2	mA
Collector-to-Emitter Sustaining Voltage[a] With base open	V_{CEO}(sus)	–	–	0.2	0	200	–	250	–	300	–	350	–	V
With external base-to-emitter resistance (R_{BE}) $\leqslant$ 50 Ω	V_{CER}(sus)	–	–	0.2	–	225	–	300	–	350	–	400	–	
Emitter-to-Base Voltage	V_{EBO}	–	–	0	0.02	6	–	6	–	6	–	6	–	V
DC Forward-Current Transfer Ratio	h_{FE}	10 10 10	– – –	0.4[b] 2[b] 4.5[b]	– – –	15 15 5	130 – –	15 15 5	130 – –	15 12 5	130 – –	15 12 5	130 – –	
Base-to-Emitter Voltage	V_{BE}	10	–	2[b]	–	–	3	–	3	–	3	–	3	V
Collector-to-Emitter Saturation Voltage	V_{CE}(sat)	– –	– –	2[b] 4.5[b]	0.25 1.125	– –	2.5 5	– –	2.5 5	– –	2.5 5	– –	2.5 5	V
Gain-Bandwidth Product	f_T	10	–	0.2	–	5	–	5	–	5	–	5	–	MHz
Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio[c] (at 1 MHz)	$\|h_{fe}\|$	10	–	0.2	–	5	–	5	–	5	–	5	–	
Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (at 1 kHz)	h_{fe}	10	–	4	–	20	–	20	–	20	–	20	–	
Output Capacitance (at 1 MHz): V_{CB} = 10 V, I_E = 0	C_{obo}	–	–	–	–	–	150	–	150	–	150	–	150	pF
Second-Breakdown Collector Current[d]: (With base forward-biased) Pulse duration (nonrepetitive) = 1 s	$I_{S/b}$	135	–	–	–	0.75	–	0.75	–	0.75	–	0.75	–	A
Second-Breakdown Energy[e]: (With base reverse-biased) L = 150 μH, R_{BE} = 50 Ω	$E_{S/b}$	–	−4	4	–	1.2	–	1.2	–	1.2	–	1.2	–	mJ
Thermal Resistance: Junction-to-case	$R_{\theta JC}$	–	–	–	–	–	1.75	–	1.75	–	1.75	–	1.75	°C/W

[a] *CAUTION:* Sustaining voltages V_{CEO}(sus) and V_{CER}(sus) *MUST NOT* be measured on a curve tracer.

[b] Pulsed, pulse duration $\leqslant$ 350 μs, duty factor = 2%.

[c] Measured at a frequency where $|h_{fe}|$ is decreasing at approximately 6 dB per octave.

[d] $I_{S/b}$ is defined as the current at which second breakdown occurs at a specified collector voltage with the emitter-base junction forward biased for transistor operation in the active region.

[e] $E_{S/b}$ is defined as the energy at which second breakdown occurs under specified reverse bias connections. $E_{S/b}$ = ½ LI^2 where L is a series load or leakage inductance, and I is the peak collector current.

BUX16, BUX16A, BUX16B, BUX16C

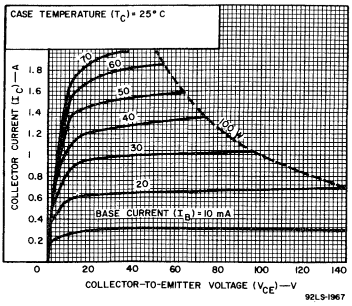


Fig. 4 — Typical output characteristics for all types.

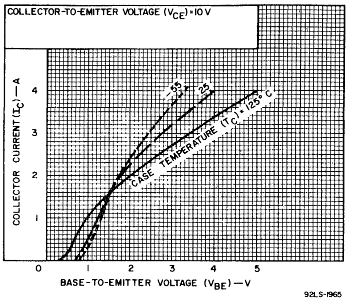


Fig. 5 — Typical transfer characteristics for all types.

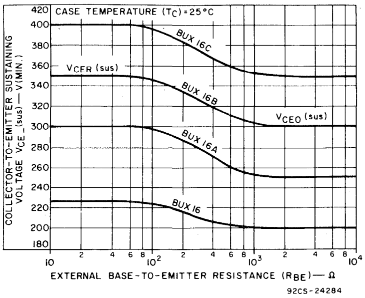


Fig. 6 — Sustaining voltage vs base-to-emitter resistance for all types.

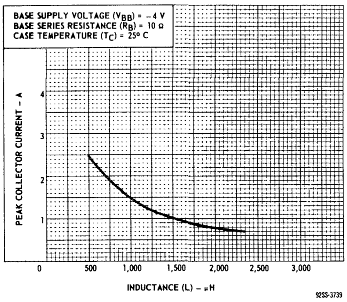


Fig. 7 — Typical reverse-bias, second-breakdown characteristic for all types.

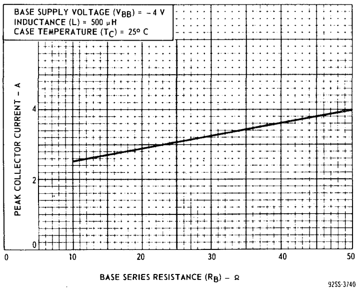


Fig. 8 — Typical reverse-bias, second-breakdown characteristic for all types.

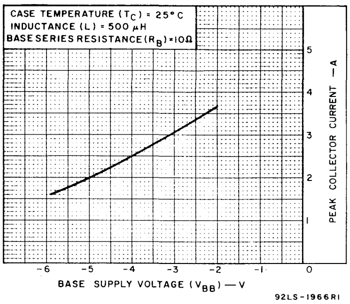


Fig. 9 — Typical reverse-bias, second-breakdown characteristic for all types.

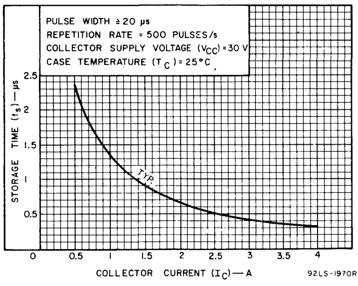


Fig. 10 — Saturated switching time (storage) vs. collector current for all types.

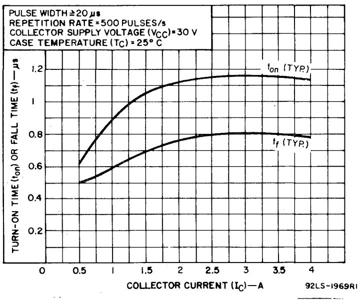


Fig. 11 — Saturated switching times (turn-on and fall) vs. collector current for all types.

BUX17, BUX17A, BUX17B, BUX17C

Silicon N-P-N Switching Transistors

For Switching Applications in Industrial and Commercial Equipment

The RCA-BUX17, BUX17A, BUX17B, and BUX17C are multiple epitaxial silicon n-p-n power transistors utilizing a multiple-emitter-site structure. Multiple-epitaxial construction maximizes the volt-ampere characteristic of the device and provides fast switching speeds. Multiple-emitter-site design assures uniform current flow throughout the structure, which produces a high $I_{S/b}$ and a large safe-operation area.

These devices use the popular JEDEC TO-3 package; they differ mainly in voltage ratings and leakage-current limits.

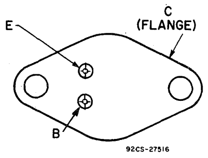
The exceptional second-breakdown capabilities and high voltage-breakdown ratings make these transistors especially suitable for off-line inverters, switching regulators, motor controls, and deflection-circuit applications.

The high breakdown voltages, low saturation voltages, and fast-switching capability of these devices make them especially suitable for inverter circuits operating directly off the rectified 115-V power line or in a bridge configuration operating from the rectified 220-V line.

Features:

- **High voltage ratings:**
  V_{CBO} = 250 V (BUX17)
  = 350 V (BUX17A)
  = 400 V (BUX17B)
  = 450 V (BUX17C)
- **High dissipation rating: P_T = 150 W**
- **Low saturation voltages**
- **Maximum safe-area-of-operation curves**

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		BUX17	BUX17A	BUX17B	BUX17C	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	250	350	400	450	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:						
With base open	$V_{CEO}(sus)$	150	250	300	350	V
With reverse bias (V_{BE}) = 0 V (with base-emitter shorted)	$V_{CEX}(sus)$	250	350	400	450	V
With external base-to-emitter resistance (R_{BE}) $\leqslant$ 50 Ω	$V_{CER}(sus)$	175	275	325	375	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	6	6	6	6	V
COLLECTOR CURRENT:						
Continuous	I_C	10	10	10	10	A
Peak	I_{CM}	30	30	30	30	A
CONTINUOUS BASE CURRENT	I_B	10	10	10	10	A
TRANSISTOR DISSIPATION:	P_T					
At case temperatures up to 25°C and V_{CE} up to 30 V		150	150	150	150	W
At case temperatures up to 25°C and V_{CE} above 30 V		See Fig. 1				
At case temperatures above 25°C		Derate linearly to 200°C				
TEMPERATURE RANGE:						
Storage & Operating (Junction)		−65 to +200				°C
PIN TEMPERATURE (During soldering):						
At distances $\geqslant$ 1/32 in. (0.8 mm) from case for 10 s max.		230				°C

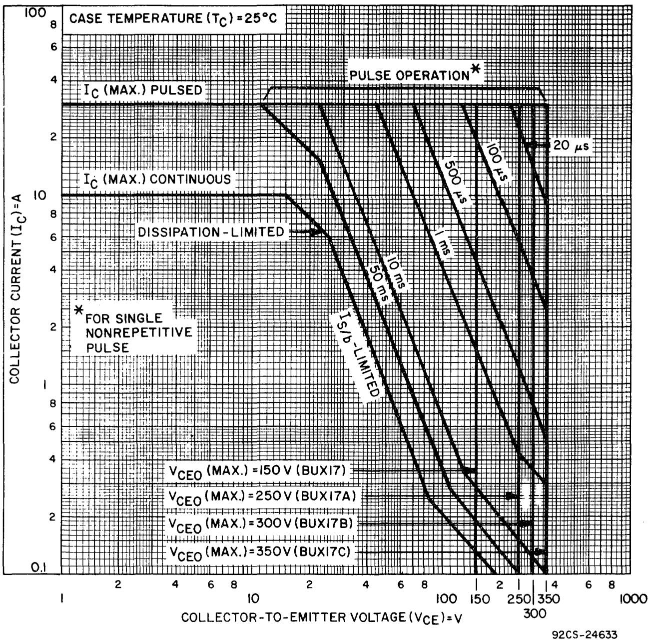


Fig. 1 — Maximum operating areas for all types.

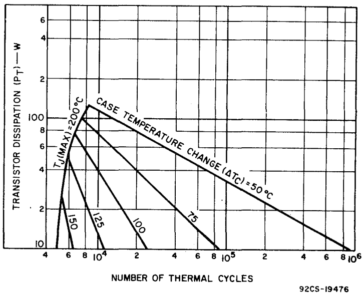


Fig. 2 — Thermal-cycling rating chart for all types.

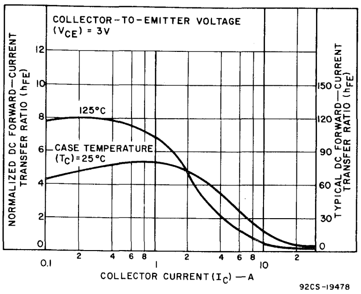


Fig. 3 — Typical normalized dc beta characteristics for all types.

BUX17, BUX17A, BUX17B, BUX17C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS								UNITS
		VOLTAGE V dc		CURRENT A dc		BUX17		BUX17A		BUX17B		BUX17C		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Collector Cutoff Current: With external base-to-emitter resistance (R_{BE}) = 50 Ω	I_{CER}	175				–	10	–	–	–	–	–	–	mA
		275				–	–	–	10	–	–	–	–	
		325				–	–	–	–	–	10	–	–	
		375				–	–	–	–	–	–	–	10	
With base-emitter junction reverse-biased	I_{CEV}	250	–1.5			–	10	–	–	–	–	–	–	
		350	–1.5			–	–	–	10	–	–	–	–	
		400	–1.5			–	–	–	–	–	5	–	–	
		450	–1.5			–	–	–	–	–	–	–	5	
At T_C = 125°C		250	–1.5			–	20	–	–	–	–	–	–	
		350	–1.5			–	–	–	20	–	–	–	–	
		400	–1.5			–	–	–	–	–	10	–	–	
		450	–1.5			–	–	–	–	–	–	–	10	
Emitter Cutoff Current	I_{EBO}		–6	0		–	2	–	2	–	2	–	2	mA
DC Forward-Current Transfer Ratio	h_{FE}	3		4^a		20	–	20	–	15	–	15	–	
		3		8		–	–	–	–	7	–	7	–	
		3		10^a		7	–	7	–	–	–	–	–	
Collector-to-Emitter Sustaining Voltage With base open	$V_{CEO}(sus)$			0.2^a		150^b	–	250^b	–	300^b	–	350^b	–	V
With external base-to-emitter resistance (R_{BE}) = 50 Ω	$V_{CER}(sus)$			0.2^a		175^b	–	275^b	–	325^b	–	375^b	–	
Base-to-Emitter Voltage	V_{BE}	3		8^a		–	–	–	–	–	3.5	–	3.5	V
		3		10^a		–	4	–	4	–	–	–	–	
Base-to-Emitter Saturation Voltage	$V_{BE}(sat)$			8^a	1.5	–	–	–	–	–	2	–	2	V
				10^a	2	–	3	–	3	–	–	–	–	
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$			8^a	1.5		–	–	–	–	3	–	3	V
				10^a	2	–	2	–	2	–	–	–	–	
Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio: f = 1 MHz	$\|h_{fe}\|$	10		1		2.5	8	2.5	8	2	8	2.5	8	
Forward-bias Second Breakdown Collector Current: t = 1 s, nonrepetitive	$I_{S/b}$	25				6	–	6	–	6	–	6	–	A
Second-Breakdown Energy: With base reverse-biased, and R_{BE} = 50 Ω, L = 40 µH	$E_{S/b}$		–4	10		2	–	2	–	2	–	2	–	mJ
Saturated Switching Time (V_{CC}= 200 V, $I_{B1} = I_{B2}$): Turn-on ($t_d + t_r$)	t_{ON}			8	1.5	–	–	–	–	–	2	–	2	µs
				10	2	–	2	–	2	–	–	–	–	
Storage	t_s			8	1.5	–	–	–	–	–	3.5	–	3.5	
				10	2	–	3.5	–	3.5	–	–	–	–	
Fall	t_f			8	1.5	–	–	–	–	–	1	–	1	
				10	2	–	1	–	1					
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$					–	1.17	–	1.17	–	1.17	–	1.17	°C/W

[a] Pulsed; pulse duration ⩽ 350 µs, duty factor = 2%.

[b] CAUTION: The sustaining voltages $V_{CEO}(sus)$ and $V_{CER}(sus)$ MUST NOT be measured on a curve tracer.

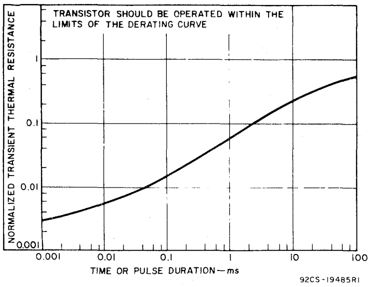


Fig. 4 – Typical thermal response characteristics for all types.

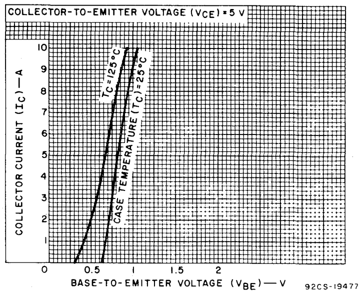


Fig. 5 – Typical transfer characteristics for all types.

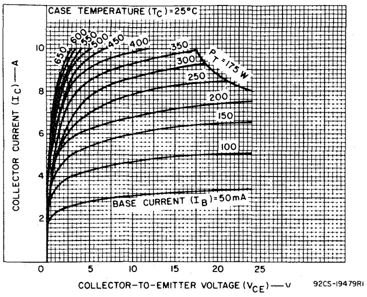


Fig. 6 – Typical output characteristics for all types.

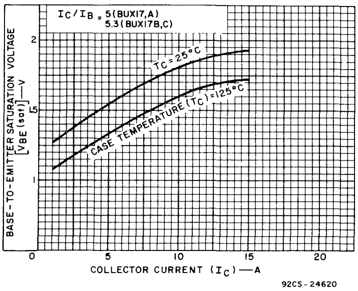


Fig. 7 – Typical base-to-emitter saturation-voltage characteristics for all types.

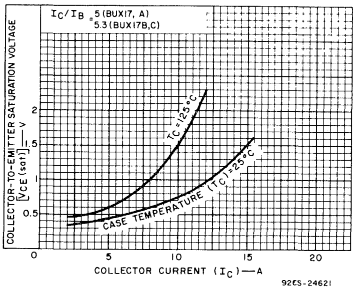


Fig. 8 – Typical collector-to-emitter saturation-voltage characteristics for all types.

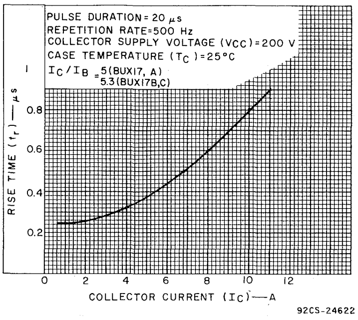


Fig. 9 – Typical rise-time characteristics for all types.

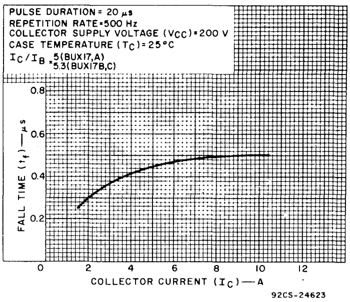


Fig. 10 – Typical fall-time characteristic for all types.

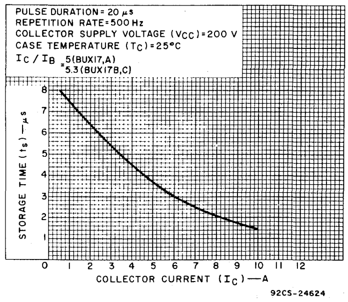


Fig. 12 – Typical inductive- and resistive-load fall-time characteristics for all types.

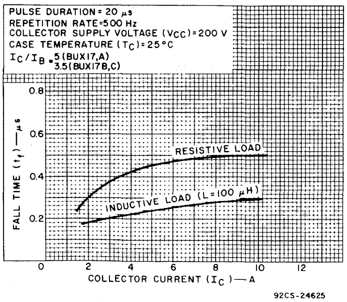


Fig. 11 – Typical storage-time characteristics for all types (with constant forced gain).

BUX18, BUX18A, BUX18B, BUX18C

High-Voltage, High-Current, Silicon N-P-N Power Switching Transistors

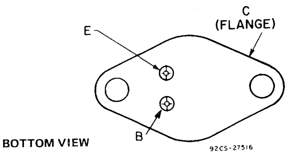
For Off-Line Switching Applications

The RCA-BUX18, BUX18A, BUX18B, and BUX18C are epitaxial silicon n-p-n power-switching transistors with pi-nu construction. They are intended for use in off-line power supplies and for other applications in which a combination of high-current-handling capability, ruggedness, and fast switching speed is required. The devices are hermetically sealed in a steel JEDEC TO-3 package, and differ from each other in collector voltage ratings.

Features:

- Fast switching speed
- Hermetic steel package—JEDEC TO-3
- Epitaxial pi-nu construction

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		BUX18	BUX18A	BUX18B	BUX18C	
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGES:						
With reverse bias, $V_{BE} = -1.5$ V	$V_{CEV}(sus)$	300	450	600	750	
With external base-to-emitter resistance ($R_{BE} = 100\Omega$)	$V_{CER}(sus)$	250	325	375	425	V
With base open	$V_{CEO}(sus)$	200	275	325	375	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	6	6	6	6	V
CONTINUOUS COLLECTOR CURRENT	I_C	8	8	8	8	A
PEAK COLLECTOR CURRENT	I_{CM}	12	12	12	12	A
CONTINUOUS BASE CURRENT	I_B	2	2	2	2	A
PEAK BASE CURRENT	I_{BM}	3	3	3	3	A
TRANSISTOR DISSIPATION:	P_T					
At case temperatures up to 25°C		120	120	120	120	W
At case temperatures above 25°C		Derate linearly at 0.68 W/°C				
TEMPERATURE RANGE:						°C
Storage and Operating (Junction)		−65 to +200				°C
LEAD TEMPERATURE (During Soldering):						
At distances ≥ 1/32 in. (0.8 mm) from case for 10 s max.		235				°C

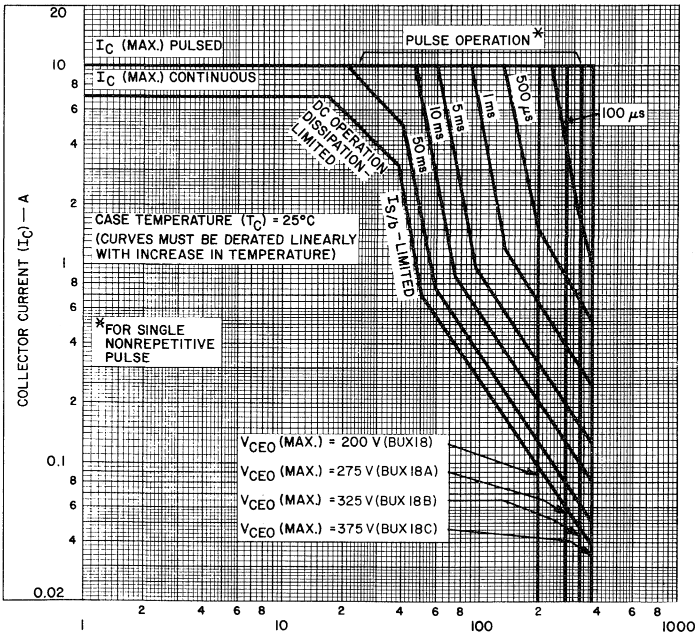


Fig. 1 – Maximum operating areas for all types.

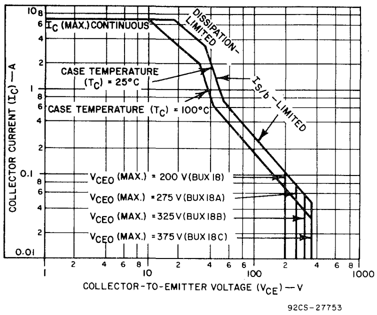


Fig. 2 – Maximum operating areas for all types at 25°C and 100°C.

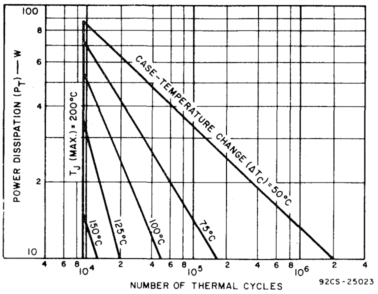


Fig. 3 – Thermal-cycling rating chart for all types.

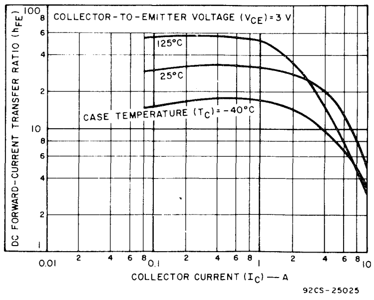


Fig. 4 – Typical dc beta characteristic for all types.

BUX18, BUX18A, BUX18B, BUX18C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified.*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS								UNITS
		VOLTAGE V dc		CURRENT A dc		BUX18		BUX18A		BUX18B		BUX18C		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Collector Cutoff Current: With external base-to-emitter resistance (R_{BE}) = 100 Ω	I_{CER}	200				–	3	–	–	–	–	–	–	mA
		275				–	–	–	3	–	–	–	–	
		325				–	–	–	–	–	3	–	–	
		400				–	–	–	–	–	–	–	3	
With base-to-emitter junction reverse-biased	I_{CEV}	300	−1.5			–	0.5	–	–	–	–	–	–	
		450	−1.5			–	–	–	0.5	–	–	–	–	
		600	−1.5			–	–	–	–	–	0.5	–	–	
		750	−1.5			–	–	–	–	–	–	–	0.5	
With base-to-emitter junction reverse-biased, and T_C = 100°C		300	−1.5			–	10	–	–	–	–	–	–	
		450	−1.5			–	–	–	10	–	–	–	–	
		600	−1.5			–	–	–	–	–	10	–	–	
		750	−1.5			–	–	–	–	–	–	–	10	
Emitter Cutoff Current	I_{EBO}		−6	0		–	3	–	3	–	3	–	3	mA
Emitter Cutoff Voltage	V_{EBO}			0	0.003	6	–	6	–	6	–	6	–	V
DC Forward-Current Transfer Ratio	h_{FE}	3		4[a]		–	–	–	–	10	–	10	–	
		3		5[a]		–	–	7	–	–	–	–	–	
		3		6[a]		7	–	–	–	–	–	–	–	
		5		1[a]		15	100	15	100	15	100	15	100	
Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$			0.2	0	200[b]	–	275[b]	–	325[b]	–	375[b]	–	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	$V_{CER}(sus)$			0.2		250[b]	–	325[b]	–	375[b]	–	425[b]	–	
Forward-Biased Second-Breakdown Collector Current: t = 1 s, nonrepetitive	$I_{S/b}$	38				3.16	–	3.16	–	3.16	–	3.16	–	A
		200				0.1	–	0.1	–	0.1	–	0.1	–	
Base-to-Emitter Saturation Voltage	$V_{BE}(sat)$			6[a]	1.2	–	2.5	–	–	–	–	–	–	V
				5[a]	1	–	–	–	2.5	–	–	–	–	
				4[a]	0.8	–	–	–	–	–	2.5	–	2.5	
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$			6[a]	1.2	–	1.5	–	–	–	–	–	–	V
				5[a]	1	–	–	–	1.5	–	–	–	–	
				4[a]	0.8	–	–	–	–	–	1.5	–	1.5	
Reverse-Bias Second-Breakdown Energy: R_{BE} = 3 kΩ, L = 40 μH	$E_{S/b}$		−1.5	3		180	–	180	–	180	—	180	–	mJ
Saturated Switching Time (I_{B1} = I_{B2}): Storage	t_s	V_{CC}= 200 V		4	0.8	–	2	–	2	–	2	–	2	μs
Fall	t_f	V_{CC} = 200 V		4	0.8	–	0.6	–	0.6	–	0.6	–	0.6	
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$					–	1.46	–	1.46	–	1.46	–	1.46	°C/W

[a] Pulsed, pulse duration = 300 μs, duty factor ⩽2%.

[b] CAUTION: Sustaining Voltages $V_{CEO}(sus)$ and $V_{CER}(sus)$, MUST NOT be measured on a curve tracer.

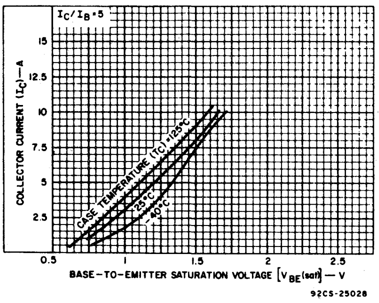


Fig. 5 — Typical collector-to-emitter saturation-voltage characteristics for all types.

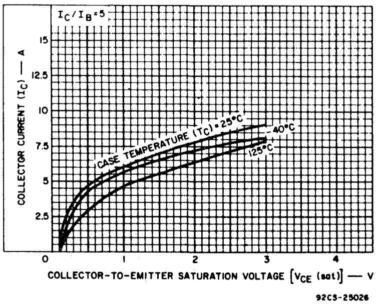


Fig. 6 — Typical base-to-emitter saturation-voltage characteristics for all types.

BUX66, BUX66A, BUX66B, BUX66C, BUX67, BUX67A, BUX67B, BUX67C

High-Voltage Silicon N-P-N and P-N-P Transistors

For High-Speed Switching and Linear-Amplifier Applications

The RCA-BUX66-series types are silicon p-n-p transistors; the RCA-BUX67-series types are silicon n-p-n transistors. All of these devices feature high breakdown voltage and fast switching speeds. They are intended for a wide variety of applications in ac/dc commercial equipment.

Typical applications include high-voltage operational and linear amplifiers, high-voltage switches, switching regulators, converters, and inverters.

The BUX66, BUX66A, BUX66B, and BUX66C are p-n-p complements to the n-p-n types BUX67, BUX67A, BUX67B, and BUX67C. All are supplied in the JEDEC TO-66 hermetic package.

Features:

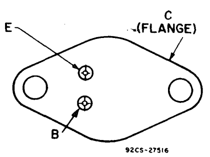
- **High voltage ratings:**
- **Large safe-operating area**
- **Thermal-cycling rating**
- **100-percent tested to assure freedom from second breakdown in both forward- and reverse-bias conditions when operated within specified limits**
- **Economy types for ac/dc circuits**
- **Fast turn-on time at high collector current**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	BUX66◆ BUX67	BUX66A◆ BUX67A	BUX66B◆ BUX67B	BUX66C◆ BUX67C	
V_{CBO}	200	300	350	400	V
$V_{CEV}(sus)$					
$V_{BE} = -1.5$ V	200	300	350	400	V
$V_{CER}(sus)$					
$R_{BE} = 100\,\Omega$	175	275	325	375	V
$V_{CEO}(sus)$	150	250	300	350	V
V_{EBO}	6	6	6	6	V
I_C	2	2	2	2	A
I_{CM}	5	5	5	5	A
I_B	1	1	1	1	A
P_T					
Up to 25°C	35	35	35	35	W
Above 25°C, Derate linearly	0.2	0.2	0.2	0.2	W/°C
T_J, T_{stg}	−65 to 200				°C
T_L At distance 1/16 in. (1.58 mm) from seating plane for 10 s max.	235	235	235	235	°C

◆ For p-n-p devices, voltage and current values are negative.

TERMINAL DESIGNATIONS



JEDEC TO-66

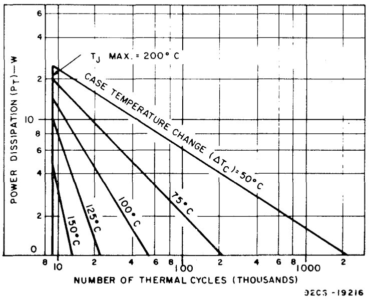


Fig. 1 – Thermal-cycling rating chart for BUX66-series types.

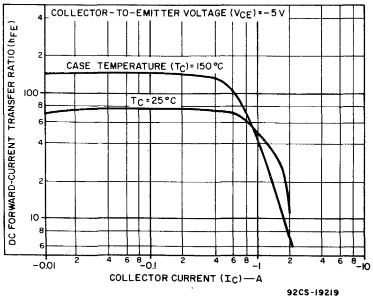


Fig. 2 – Typical dc beta characteristics for BUX66-series types.

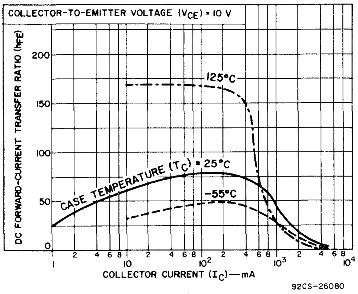


Fig. 3 – Typical dc beta characteristics for BUX67-series types.

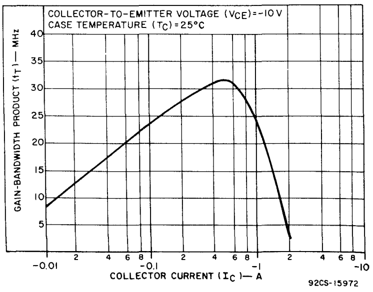


Fig. 4 – Typical gain-bandwidth product for BUX66-series types.

BUX66, BUX66A, BUX66B, BUX66C, BUX67, BUX67A, BUX67B, BUX67C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C*
Unless Otherwise Specified

CHARACTERISTIC SYMBOL	TEST CONDITIONS♦				LIMITS								UNITS
	VOLTAGE V dc		CURRENT A dc		BUX66♦ BUX67		BUX66A♦ BUX67A		BUX66B♦ BUX67B		BUX66C♦ BUX67C		
	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
I_{CEO}	150			0	–	10	–	10	–	–5	–	–5	mA
I_{CEX}	200	–1.5			–	8	–	–	–	–	–	–	
	300	–1.5			–	–	–	8	–	–	–	–	
	350	–1.5			–	–	–	–	–	–8	–	–	
	400	–1.5			–	–	–	–	–	–	–	–8	
T_C = 100°C	200	–1.5			–	10	–	–					
	300	–1.5			–	–	–	10					
	350	–1.5			–	10	–	–	–	–10	–	–	
	400	–1.5			–	–	–	10	–	–	–	–10	
I_{EBO}		–6	0		–	1	–	1	–	1	–	1	mA
h_{FE}	5		1^a		10	150	10	150	10	150	10	150	
$V_{CEO(sus)}$			0.2^a	0	150^c	–	250^c	–	-300^c	–	-350^c	–	V
$V_{CER(sus)}$ R_{BE} = 50 Ω			0.2		175^c	–	275^c	–	-325^c	–	-375^c	–	
$V_{BE(sat)}$			1^a	0.15	–	1.5	–	1.5	–	–1.5	–	–1.5	V
$V_{CE(sat)}$			1^a	0.15	–	2.5	–	2.5	–	–2.5	–	–2.5	V
C_{obo} V_{CB} = 10 V f = 1 MHz													pF
BUX67 Types			0		–	120	–	120	–	220	–	220	
BUX66 Types			0		–	200	–	200	–	220	–	220	
$I_{S/b}$ t = 1 s, nonrep.	40				875	–	875	–	–875	–	–875	–	mA
$E_{S/b}$ L = 100 µH R_{BE} = 20 Ω		–4			50	–	200	–	200	–	50	–	µJ
$\|h_{fe}\|$ f = 5 MHz													
BUX67 Types	10		0.2		2	–	2	–	2	–	2	–	
BUX66 Types	–10		–0.2		4	–	4	–	4	–	4	–	
t_r V_{CC} = 200 V													µs
BUX67 Types			1	0.1^b	–	3	–	3	–	3	–	3	
BUX66 Types			–1	-0.10^b	–	0.6	–	0.6	–	0.6	–	0.6	
t_s V_{CC} = 200 V													
BUX67 Types			1	0.1^b	–	4	–	4	–	4	–	4	
BUX66 Types			–1	-0.10^b	–	2.5	–	2.5	–	2.5	–	2.5	
t_f V_{CC} = 200 V													
BUX67 Types			1	0.1^b	–	3	–	3	–	3	–	3	
BUX66 Types			–1	-0.10^b	–	0.6	–	0.6	–	0.6	–	0.6	
$R_{\theta JC}$						5	–	5	–	5	–	5	°C/W

[a] Pulsed: Pulse duration = 300 µs; duty factor ⩽ 2%. [b] $I_{B1} = I_{B2}$ ♦For p-n-p devices, voltage and current values are negative.

[c] Sustaining voltages, V_{CEO}(sus) and V_{CER}(sus) MUST NOT be measured on a curve tracer.

BUX66, BUX66A, BUX66B, BUX66C, BUX67, BUX67A, BUX67B, BUX67C

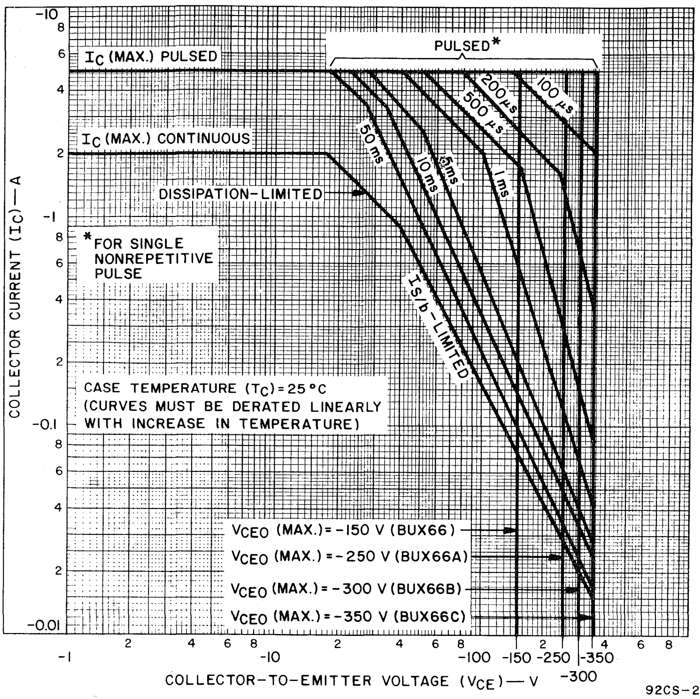


Fig. 5 — Maximum operating areas for BUX66-series types.

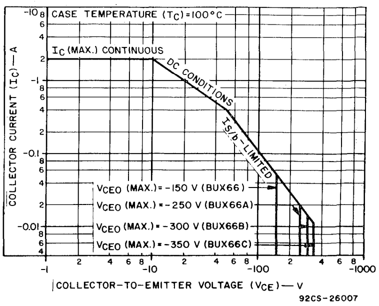


Fig. 7 — Maximum operating areas for BUX66-series at $T_C = 100^\circ C$.

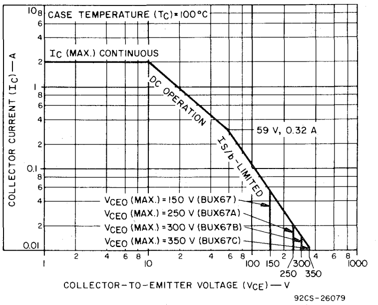


Fig. 8 — Maximum operating areas for BUX67-series at $T_C = 100^\circ C$.

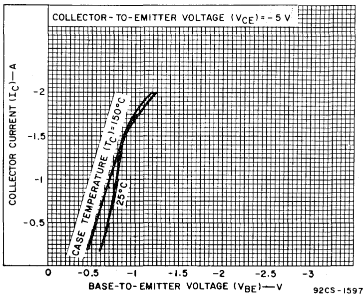


Fig. 9 — Typical transfer characteristics for BUX66-series types.

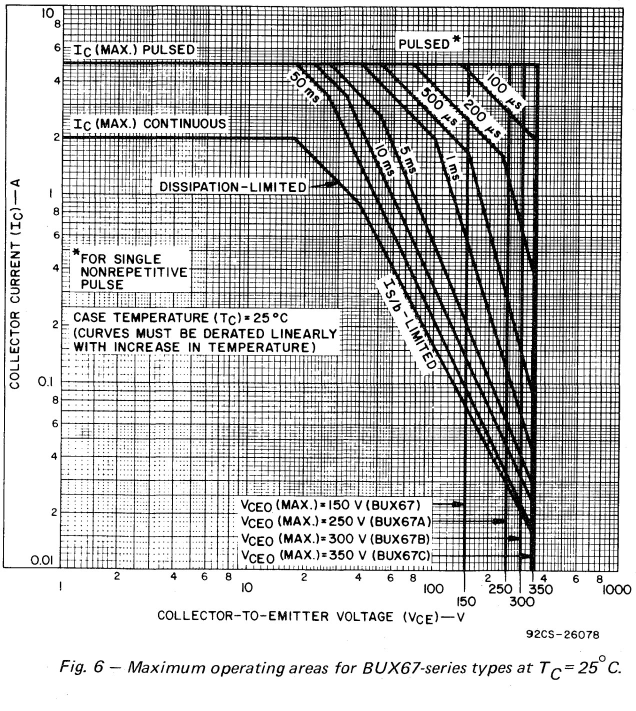


Fig. 6 — Maximum operating areas for BUX67-series types at $T_C = 25^\circ C$.

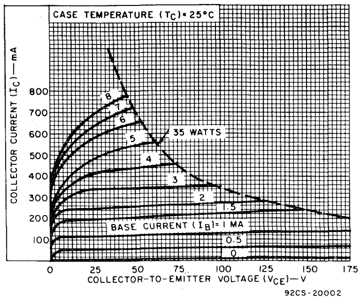


Fig. 10 — Typical output characteristics for BUX67-series types.

BUX66, BUX66A, BUX66B, BUX66C, BUX67, BUX67A, BUX67B, BUX67C

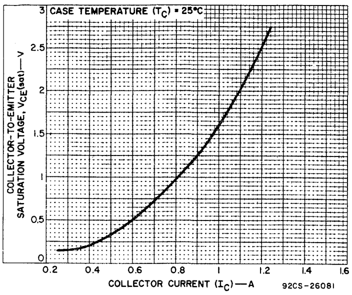


Fig. 11 — Typical saturation-voltage characteristic for BUX67-series types.

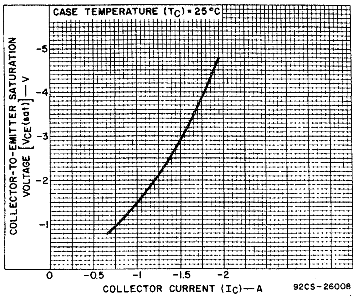


Fig. 12 — Typical saturation-voltage characteristic for BUX66-series types.

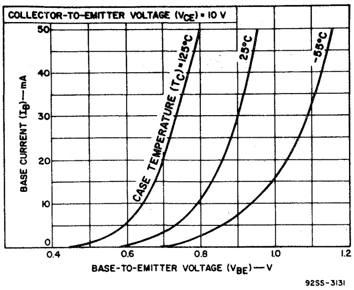


Fig. 13 — Typical input characteristics for BUX67-series types.

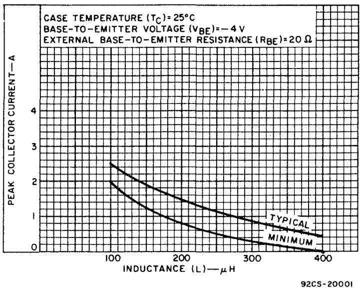


Fig. 14 — Reverse-bias second-breakdown characteristics for BUX67-series types.

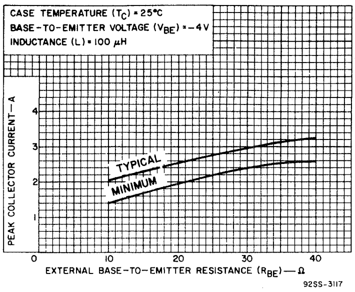


Fig. 15 — Reverse-bias second-breakdown characteristics for BUX67-series types.

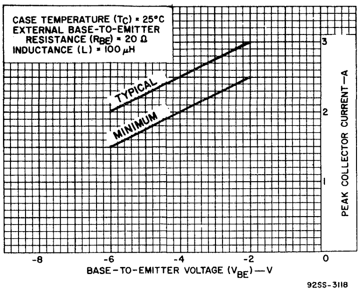


Fig. 16 — Reverse-bias second-breakdown characteristics for BUX67-series types.

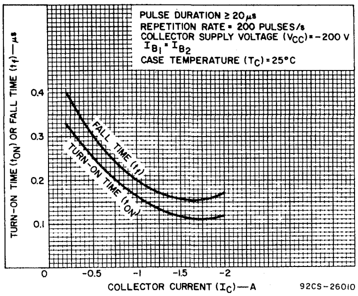


Fig. 17 — Typical turn-on time and fall-time characteristics for BUX66-series types.

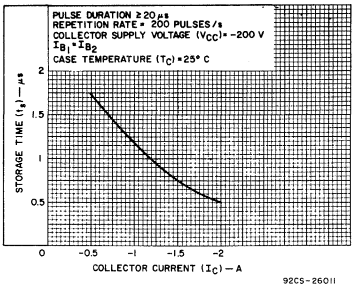


Fig. 18 — Typical storage-time characteristic for BUX66-series types.

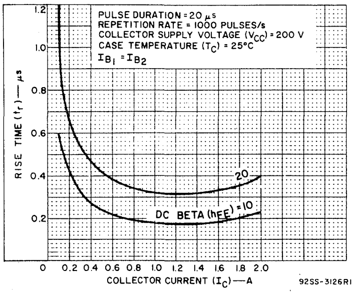


Fig. 19 — Typical rise time vs. collector current for BUX67-series types.

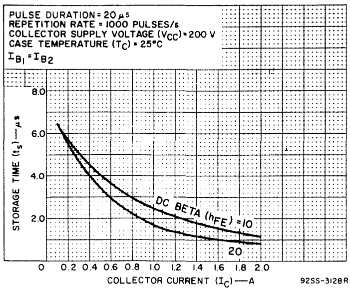


Fig. 20 — Typical storage time vs. collector current for BUX67-series types.

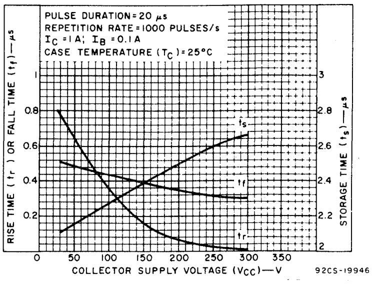


Fig. 21 — Typical rise time, fall time, and storage time vs. collector supply voltage for BUX67-series types.

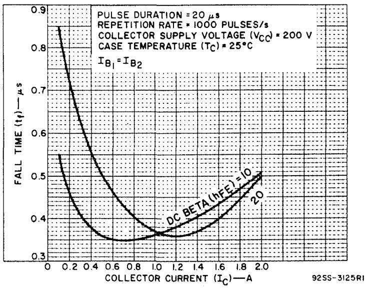


Fig. 22 — Typical fall time vs. collector current for BUX67-series types.

RCA1A01–RCA1A11, RCA1A15–RCA1A19

Silicon Transistors for Audio-Frequency Linear-Amplifier Applications

"RCA1A-Series" n-p-n and p-n-p silicon transistors are especially characterized for audio-amplifier applications. They are particularly useful as input devices, V_{BE} multipliers for biasing, current sources, load-line-limiting (protection) circuits, predrivers, and in some instances as complementary drivers. Other applications for these devices include audio power amplifiers, linear modulators, servo amplifiers, and operational amplifiers. The units are supplied in the JEDEC TO-39 package.

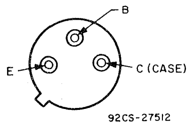
N-P-N TYPES

RCA1A01
RCA1A03
RCA1A06
RCA1A07
RCA1A09
RCA1A11
RCA1A15
RCA1A17
RCA1A18

P-N-P TYPES

RCA1A02
RCA1A04
RCA1A05
RCA1A08
RCA1A10
RCA1A16
RCA1A19

TERMINAL DESIGNATIONS



JEDEC TO-39

MAXIMUM RATINGS, *Absolute-Maximum Values:*		RCA1A01	RCA1A02	RCA1A03	RCA1A04	RCA1A05	RCA1A06	RCA1A07	RCA1A08	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	–	–	95	–95	–75	75	50	–50	V
COLLECTOR-TO-EMITTER VOLTAGE:										
With base open	V_{CEO}	70	–50	–	–	–	–	40	–40	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	V_{CER}	–	–	95	–95	–75	75	50●	–50▲	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	4	–4	4	–4	–4	4	3	–5	V
COLLECTOR CURRENT	I_C	1	–1	2	–2	–1	1	1	–1	A
BASE CURRENT	I_B	0.5	–0.5	1	–1	–0.5	0.5	0.05	–0.05	A
TRANSISTOR DISSIPATION:	P_T									
At case temperatures up to 25°C		5	7	10	10	5	5	5	7	W
At case temperatures above 25°C		← See Fig. 1 →								
TEMPERATURE RANGE:										
Storage & Operating (Junction)		← –65 to +200 →								°C
PIN TEMPERATURE (During Soldering):										
At distances ≥ 1/32 in. (0.8 mm) from case for 10 s max.		← 230 →								°C

●R_{BE} = 10 Ω ▲R_{BE} = 300 Ω

MAXIMUM RATINGS, *Absolute-Maximum Values:*		RCA1A09	RCA1A10	RCA1A11	RCA1A15	RCA1A16	RCA1A17	RCA1A18	RCA1A19	
COLLECTOR-TO-EMITTER VOLTAGE:										
With base open	V_{CEO}	175	–175	175	100	–100	90	10	–10	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	6	–6	6	5	–5	4	4	–4	V
COLLECTOR CURRENT	I_C	1	–1	1	1	–1	1	1	–1	A
BASE CURRENT	I_B	0.5	–0.5	0.5	0.5	–0.1	0.5	0.5	–0.5	A
TRANSISTOR DISSIPATION:	P_T									
At case temperatures up to 25°C		10	10	10	10	10	5	7	7	W
At case temperatures above 25°C		← See Fig. 1 →								
TEMPERATURE RANGE:										
Storage & Operating (Junction)		← –65 to +200 →								°C
PIN TEMPERATURE (During Soldering):										
At distances ≥ 1/32 in. (0.8 mm) from case for 10 s max.		← 230 →								°C

Type RCA1A01

Package: JEDEC TO-39
Construction: Silicon n-p-n, planar

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CEO}	V_{CE} = 60 V, I_B = 0	–	1	μA
I_{EBO}	V_{EB} = 4 V, I_C = 0	–	1	mA
V_{CEO}	I_C = 100 mA	70	–	V
f_T	V_{CE} = 4 V, I_C = 50 mA	120	–	MHz
h_{FE}	I_C = 10 mA, V_{CE} = 4 V	40	200	
V_{CE}(sat)	I_C = 150 mA, I_B = 15 mA	–	1.4	V
V_{BE}	I_C = 10 mA, V_{CE} = 4 V	–	1	V

For characteristics curves and test conditions, refer to published data for prototype 2N2102

Type RCA1A02

Package: JEDEC TO-39
Construction: Silicon p-n-p, epitaxial planar

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CEO}	V_{CE} = –40 V, I_B = 0	–	–1	μA
I_{EBO}	V_{EB} = –4 V, I_C = 0	–	–1	mA
V_{CEO}	I_C = –0.1 A	–50	–	V
f_T	V_{CE} = –4 V, I_C = –50 mA	60	–	MHz
h_{FE}	I_C = –0.1 mA, V_{CE} = –10 V	30	200	
V_{BE}	I_C = –0.1 mA, V_{CE} = –10 V	–	–0.8	V

For characteristics curves and test conditions, refer to published data for prototype 2N4036

RCA1A01–RCA1A11, RCA1A15–RCA1A19

Type RCA1A03
Package: JEDEC TO-39
Construction: Silicon n-p-n, planar

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = 85 V, R_{BE} = 100Ω	–	10	μA
I_{EBO}	V_{EB} = 4 V, I_C = 0	–	0.1	mA
V_{CER}	I_C = 0.1 A, R_{BE} = 100Ω	95	–	V
f_T	I_C = 0.1 A, V_{CE} = 4 V	50	–	MHz
h_{FE}	I_C = 300 mA, V_{CE} = 4 V	70	300	
V_{CE}(sat)	I_C = 300 mA, I_B = 30 mA	–	0.8	V
V_{BE}	I_C = 300 mA, V_{CE} = 4 V	–	1.4	V
$I_{S/b}$	V_{CE} = 50 V, t = 0.4 s	0.2	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N5320

Type RCA1A05
Package: JEDEC TO-39
Construction: Silicon p-n-p epitaxial planar

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = –65 V, R_{BE} = 100Ω	–	–10	μA
I_{EBO}	V_{EB} = –4 V, I_C = 0	–	–0.1	mA
V_{CER}	I_C = –0.1 A, R_{BE} = 100Ω	–75	–	V
f_T	I_C = –50 mA, V_{CE} = –4 V	60		MHz
h_{FE}	I_C = –150 mA, V_{CE} = –4 V	50	250	
V_{CE}(sat)	I_C = –150 mA, I_B = –15 mA	–	–0.8	V
V_{BE}	I_C = –150 mA, V_{CE} = –4 V	–	–1.4	V
$I_{S/b}$	V_{CE} = –65 V, t = 0.4 s	–0.1	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N4036

Type RCA1A07
Package: JEDEC TO-39
Construction: Silicon n-p-n, planar

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CEO}	V_{CE} = 40 V	–	10	μA
I_{EBO}	V_{EB} = 3 V, I_C = 0	–	0.1	mA
V_{CEO}	I_C = 100 mA	40	–	V
V_{CER}	I_C = 100 mA, R_{BE} = 10Ω	50	–	V
f_T	V_{CE} = 10 V, I_C = 50 mA	120	–	MHz
h_{FE}	I_C = 3 mA, V_{CE} = 10 V	50	250	
V_{CE}(sat)	I_C = 20 mA, I_B = 1 mA	–	1	V
V_{BE}(sat)	I_C = 20 mA, I_B = 1 mA	–	1.3	V

For characteristics curves and test conditions, refer to published data for prototype 2N2102

Type RCA1A04
Package: JEDEC TO-39
Construction: Silicon p-n-p, epitaxial-planar

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = –85 V, R_{BE} = 100Ω	–	–10	μA
I_{EBO}	V_{EB} = 4 V, I_C = 0	–	–0.1	mA
V_{CER}	I_C = –0.1 A, R_{BE} = 100Ω	–95	–	V
f_T	I_C = –0.1 A, V_{CE} = –4 V	50	–	MHz
h_{FE}	I_C = –300 mA, V_{CE} = –4 V	70	300	
V_{CE}(sat)	I_C = –300 mA, I_B = –30 mA	–	–0.8	V
V_{BE}	I_C = –300 mA, V_{CE} = –4 V	–	–1.4	V
$I_{S/b}$	V_{CE} = –35 V, t = 0.4 s	0.285	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N5322

Type RCA1A06
Package: JEDEC TO-39
Construction: Silicon n-p-n, planar

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = 65V, R_{BE} = 100Ω	–	10	μA
I_{EBO}	V_{EB} = 4V, I_C = 0	–	0.1	mA
V_{CER}	I_C = 100 mA, R_{BE} = 100Ω	75	–	V
f_T	I_C = 50 mA, V_{CE} = 4 V	120	–	MHz
h_{FE}	I_C = 150 mA, V_{CE} = 4V	50	250	
V_{CE}(sat)	I_C = 150 mA, I_B = 15 mA	–	0.8	V
V_{BE}	I_C = 150 mA, V_{CE} = 4V	–	1.4	V
$I_{S/b}$	V_{CE} = 65V, t = 0.4 s	0.077	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N2102

Type RCA1A08
Package: JEDEC TO-39
Construction: Silicon p-n-p, epitaxial planar

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = –40 V, R_{BE} = 330Ω	–	–10	μA
I_{EBO}	V_{EB} = –5 V	–	–0.1	mA
V_{CEO}	I_C = –100 mA, I_B = 0	–40	–	V
V_{CER}	I_C = –100 mA, R_{BE} = 330Ω	–50	–	V
f_T	V_{CE} = –10 V, I_C = –50 mA	60	–	MHz
h_{FE}	I_C = –50 mA, V_{CE} = –1.5 V	70	250	
V_{CE}(sat)	I_C = –100 mA, I_B = –5 mA	–	–1.4	V
V_{BE}(sat)	I_C = –100 mA, I_B = –5 mA	–	–1.4	V
$I_{S/b}$	V_{CE} = –35 V, t = 0.05 s	–0.12	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N4036

RCA1A01–RCA1A11, RCA1A15–RCA1A19

Type RCA1A09
Package: JEDEC TO-39
Construction: Silicon n-p-n, epitaxial

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CEO}	V_{CE} = 90 V, I_B = 0	–	10	μA
I_{EBO}	V_{EB} = 6 V, I_C = 0	–	100	μA
V_{CEO}	I_C = 10 mA, I_B = 0	175	–	V
f_T	I_C = 10 mA, V_{CE} = 10 V	15	–	MHz
h_{FE}	I_C = 10 mA, V_{CE} = 10 V	20	100	
V_{CE}(sat)	I_C = 50 mA, I_B = 4 mA	–	0.5	V
V_{BE}	I_C = 10 mA, V_{CE} = 10 V	–	0.9	V
$I_{S/b}$	V_{CE} = 150 V, t = 1 s	0.065	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N3439

Type RCA1A10
Package: JEDEC TO-39
Construction: Silicon p-n-p

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CEO}	V_{CE} = –120 V, I_B = 0	–	–10	μA
I_{EBO}	V_{EB} = –6 V, I_C = 0	–	–100	μA
V_{CEO}	I_C = –10 mA, I_B = 0	–175	–	V
f_T	I_C = –10 mA, V_{CE} = –10 V	15	–	MHz
h_{FE}	I_C = –10 mA, V_{CE} = –10 V	40	250	
V_{CE}(sat)	I_C = –10 mA, I_B = –1 mA	–	–2	V
V_{BE}	I_C = –10 mA, V_{CE} = –10 V	–	–0.8	V
$I_{S/b}$	V_{CE} = –150 V, t = 1 s	–0.04	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N5415

Type RCA1A11
Package: JEDEC TO-39
Construction: Silicon n-p-n, epitaxial

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CEO}	V_{CE} = 90 V, I_B = 0	–	10	μA
I_{EBO}	V_{EB} = 6 V, I_C = 0	–	100	μA
V_{CEO}	I_C = 10 mA, I_B = 0	175	–	V
f_T	I_C = 10 mA, V_{CE} = 10 V	15	–	MHz
h_{FE}	I_C = 1 mA, V_{CE} = 10 V	40	250	
V_{BE}	I_C = 1 mA, V_{CE} = 10 V	0.5	0.7	V

For characteristics curves and test conditions, refer to published data for prototype 2N3439

Type RCA1A15
Package: JEDEC TO-39
Construction: Silicon n-p-n, epitaxial

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CEO}	V_{CE} = 90 V	–	10	μA
I_{EBO}	V_{EB} = 5 V, I_C = 0	–	1	mA
V_{CEO}	I_C = 10 mA, I_B = 0	100	–	V
f_T	V_{CE} = 10 V, I_C = 10 mA	15	–	MHz
h_{FE}	I_C = 10 mA, V_{CE} = 10 V	20	100	
V_{CE}(sat)	I_C = 10 mA, I_B = 1 mA	–	1	V
V_{BE}	I_C = 10 mA, V_{CE} = 10 V	–	1	V
$I_{S/b}$	V_{CE} = 50 V, t = 0.4 s	0.2	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N3440

Type RCA1A16
Package: JEDEC TO-39
Construction: Silicon p-n-p, epitaxial

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CEO}	V_{CE} = –90 V	–	–10	μA
I_{EBO}	V_{EB} = –5 V, I_C = 0	–	–1	mA
V_{CEO}	I_C = –10 mA, I_B = 0	–100	–	V
f_T	V_{CE} = –10 V, I_C = –10 mA	15	–	MHz
h_{FE}	I_C = –10 mA, V_{CE} = –10 V	40	250	
V_{CE}(sat)	I_C = –10 mA, I_B = –1 mA	–	–1	V
V_{BE}	I_C = –10 mA, V_{CE} = –10 V	–	–1	V
$I_{S/b}$	V_{CE} = –50 V, t = 0.4 s	–0.2	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N5416

Type RCA1A17
Package: JEDEC TO-39
Construction: Silicon n-p-n, planar

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CEO}	V_{CE} = 80 V, I_B = 0	–	1	μA
I_{EBO}	V_{EB} = 4 V, I_C = 0	–	1	mA
V_{CEO}	I_C = 100 mA, I_B = 0	90	–	V
f_T	V_{CE} = 4 V, I_C = 50 mA	120	–	MHz
h_{FE}	I_C = 10 mA, V_{CE} = 4V	40	200	
V_{CE}(sat)	I_C = 150 mA, I_B = 15 mA	–	1.4	V
V_{BE}	I_C = 10 mA, V_{CE} = 4 V	–	1	V

For characteristics curves and test conditions, refer to published data for prototype 2N2102

Type RCA1A18
Package: JEDEC TO-39
Construction: Silicon n-p-n, planar

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CEO}	V_{CE} = 5 V, I_B = 0	–	10	μA
I_{EBO}	V_{EB} = 4 V, I_C = 0	–	1	mA
V_{CEO}	I_C = 10 mA, I_B = 0	10	–	V
f_T	I_C = 50 mA, V_{CE} = 4 V	120	–	MHz
h_{FE}	I_C = 10 mA, V_{CE} = 4 V	40	250	
V_{CE}(sat)	I_C = 10 mA, I_B = 0.5 mA	–	1	V
V_{BE}	I_C = 10 mA, V_{CE} = 4 V	–	0.78	V

For characteristics curves and test conditions, refer to published data for prototype 2N2102

Type RCA1A19
Package: JEDEC TO-39
Construction: Silicon p-n-p, epitaxial planar

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

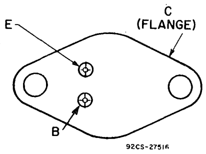
CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CEO}	V_{CE} = –5 V, I_B = 0	–	–10	μA
I_{EBO}	V_{EB} = –4 V, I_C = 0	–	–1	mA
V_{CEO}	I_C = –10 mA, I_B = 0	–10	–	V
f_T	I_C = –50 mA, V_{CE} = –4 V	60	–	MHz
h_{FE}	I_C = –10 mA, V_{CE} = –4 V	40	250	
V_{CE}(sat)	I_C = –10 mA, I_B = –0.5 mA	–	–1	V
V_{BE}	I_C = –10 mA, V_{CE} = –4 V	–	–0.78	V

For characteristics curves and test conditions, refer to published data for prototype 2N4036

RCA1B01

Silicon Transistor for 70-Watt Quasi-Complementary-Symmetry Audio Amplifiers with Hometaxial-Base Output Transistors

TERMINAL DESIGNATIONS



JEDEC TO-3

RCA1B01 is an n-p-n hometaxial-base silicon transistor in a JEDEC TO-3 package. This device is particularly suitable for audio-output use, and can be driven by either the RCA1A03 n-p-n or RCA1A04 p-n-p transistor.

The 70-watt amplifier shown in Fig. 4 uses the RCA1B01 in conjunction with seven TO-39 transistors, eleven diodes, and an 84-volt split power supply. The amplifier output is directly coupled to an 8-ohm speaker. This amplifier is most useful for instrumentation applications where ruggedness and raw power are essential.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		RCA1B01	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	95	V
COLLECTOR-TO-EMITTER VOLTAGE:			
With external base-to-emitter resistance (R_{BE}) = 100Ω	V_{CER}	95	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	V
COLLECTOR CURRENT	I_C	15	A
BASE CURRENT	I_B	7	A
TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 25°C		115	W
At case temperatures above 25°C		Derate linearly to 200°C	
TEMPERATURE RANGE:			
Storage & Operating (Junction)		−65 to 200	°C
PIN TEMPERATURE (During Soldering):			
At distances ≥ 1/32 in. (0.8 mm) from case for 10 s max		230	°C

Type RCA1B01
Package: JEDEC TO-3
Construction: Silicon n-p-n, hometaxial base

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = 85 V, R_{BE} = 100Ω	–	0.5	mA
I_{EBO}	V_{EB} = 4 V, I_C = 0	–	1	mA
V_{CER}	I_C = 0.2A, R_{BE} = 100Ω	95	–	V
f_T	V_{CE} = 4 V, I_C = 1 A	0.8	–	MHz
h_{FE}	I_C = 4 A, V_{CE} = 4 V	20	70	
V_{CE}(sat)	I_C = 4 A, I_B = 0.4 A	–	1	V
V_{BE}	I_C = 4 A, V_{CE} = 4 V	–	1.4	V
$I_{S/b}$	V_{CE} = 60 V, t = 1 s	1.95	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N3055H.

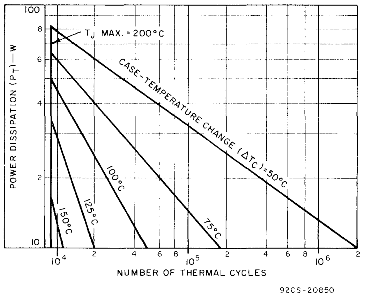
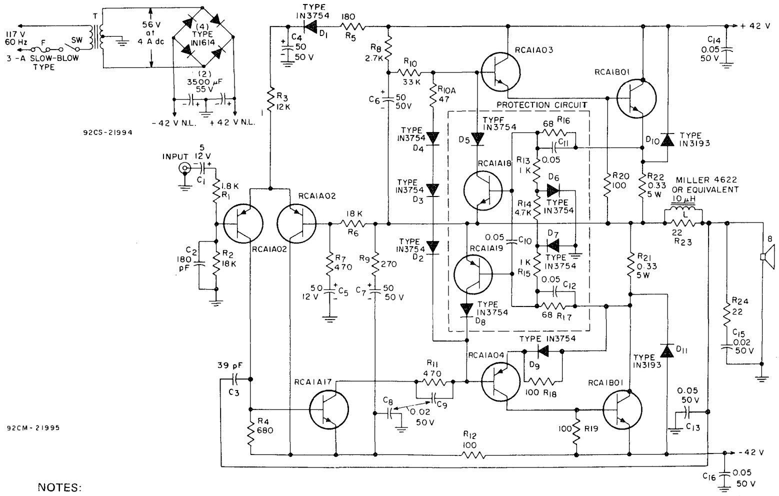


Fig. 2 — Thermal-cycling ratings for RCA1B01.



NOTES:

1. T: Signal 56-4•, Signal Transformer Co., 1 Junius St., Brooklyn, N.Y. 11212

Resistors are 1/2-watt unless otherwise specified; values are in ohms.

3. Capacitances are in μF unless otherwise specified.
4. Non-inductive resistors. • Or equivalent.

Fig. 1 — 70-Watt amplifier circuit featuring quasi-complementary-symmetry output employing hometaxial-base output transistors.

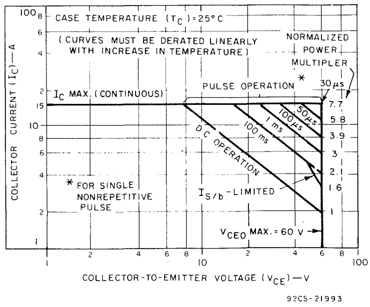
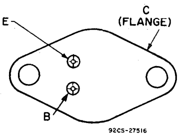


Fig. 3 — Maximum operating areas for RCA1B01.

RCA1B04, RCA1B05, RCA1B09

Silicon Transistors for 100-, 120-, 200-, and 300-W Quasi-Complementary-Symmetry Audio Amplifiers with Parallel Output Transistors

TERMINAL DESIGNATIONS



JEDEC TO-3

The RCA1B04, RCA1B05, and RCA1B09 are silicon n-p-n pi-nu transistors in a JEDEC TO-3 package. They are especially suitable for applications in audio-amplifier circuits, in which they may be used as either driver or output unit.

These devices, together with a variety of other transistors that serve as input devices, V_{BE} amplifiers for biasing, current sources, load-line limiters (for overload protection), and predrivers, may be used to develop several hundred watts of audio output power in quasi-complementary-symmetry audio-amplifier configurations that employ parallel output transistors. Circuit examples, data are shown for 100-, 120-, 200-, and 300-W amplifiers.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	RCA1B04	RCA1B05 RCA1B09	
V_{CBO}	225	275	V
V_{CEO}	200	250	V
V_{CER} R_{BE} = 100 Ω	225	275	V
V_{EBO}	5		V
I_C	7		V
I_B	2		A
P_T			
At $T_C \leqslant 25^oC$	150		W
At $T_C > 25^oC$	Derate linearly to 200 °C		
T_{stg}, T_J	−65 to 200		^oC
T_L			
At distance ⩾ 1/32 in. (0.8 mm) from seating plane for 10 s max.	230		^oC

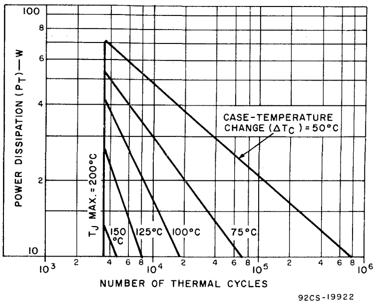


Fig. 1 — Thermal-cycling ratings for RCA1B04 and RCA1B05.

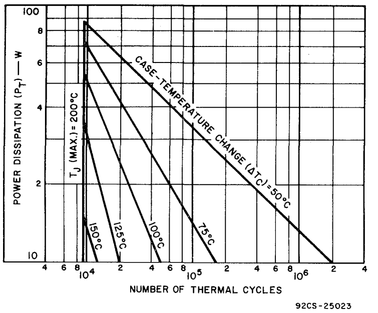


Fig. 2 — Thermal-cycling rating chart for RCA1B09.

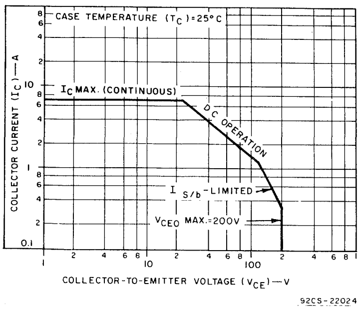


Fig. 3 — Maximum operating areas for RCA1B04.

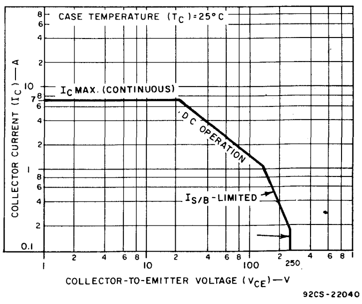


Fig. 4 — Maximum operating areas for RCA1B05.

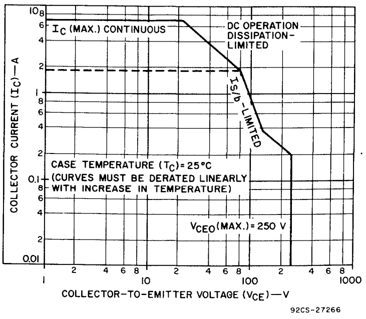


Fig. 5 — Maximum operating areas for RCA1B09.

RCA1B04, RCA1B05, RCA1B09

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C*

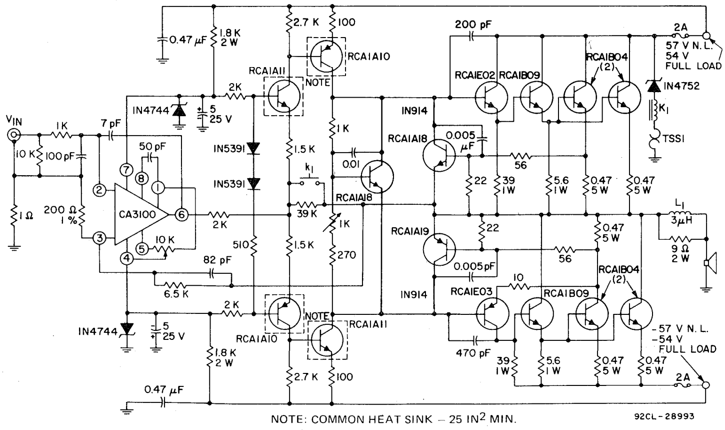
CHARAC-TERISTIC	TEST CONDITIONS	LIMITS						UNITS
		RCA1B04▲		RCA1B05*		RCA1B09**		
		Min.	Max.	Min.	Max.	Min.	Max.	
I_{CER}	V_{CE} = 120 V, R_{BE} = 100 Ω	–	1	–	–	–	–	mA
	V_{CE} = 200 V, R_{BE} = 100 Ω	–	–	–	1	–	1	
I_{EBO}	V_{EB} = 5 V, I_C = 0	–	1	–	1	–	1	mA
V_{CEO}	I_C = 0.2 A, I_B = 0	200	–	250	–	250	–	V
V_{CER}	I_C = 0.2 A, R_{BE} = 100 Ω	225	–	275	–	275	–	V
f_T	I_C = 0.2 A, V_{CE} = 10 V	5	–	5	–	–	–	MHz
	I_C = 1 A, V_{CE} = 15 V	–	–	–	–	5	–	
h_{FE}	I_C = 2 A, V_{CE} = 5 V	15	75	15	75	40	–	
$V_{CE}(sat)$	I_C = 2 A, I_B = 0.255 A	–	2	–	2	–	–	V
	I_C = 2 A, I_B = 0.2 A	–	–	–	–	–	1	
V_{BE}	I_C = 2 A, V_{CE} = 5 V	0.75	1.75	0.75	1.75	–	1	V
$I_{S/b}$	V_{CE} = 120 V, t = 1 s	1.25	–	–	–	–	–	A
	V_{CE} = 140 V, t = 1 s	–	–	1.07	–	–	–	
	V_{CE} = 80 V, t = 1 s	–	–	–	–	1.875	–	

▲ For characteristics curves and test conditions, refer to published data for prototype 2N5239
* For characteristics curves and test conditons, refer to published data for prototype 2N5240
** For characteristics curves and test conditions, refer to published data for prototype 2N6510

100-W Amplifier

The 100-W amplifier shown in Figs. 6 and 7 uses two RCA1B09 transistors as drivers and four RCA1B05 transistors as parallel units in the amplifier output stages, and operates on a 104-V split power supply.

This 100-W amplifier [DC-Coupled (Fig.6) or AC-Coupled (Fig.7)] is conservatively designed to provide excellent high-power performance into an 8-Ω load. With the exception of the RCA-CA3100 Linear Integrated Circuit for front end, this amplifier is entirely push-pull for improved high-frequency distortion and slew rate. Additional circuit features include new thermal overload protection and instant turn-on with no undesirable transients.

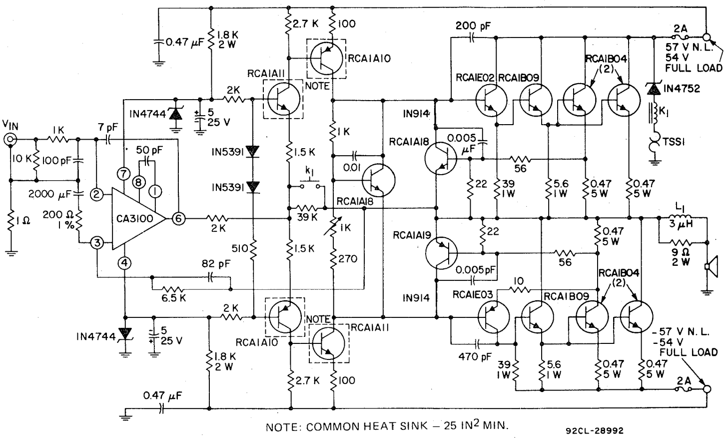


NOTE: COMMON HEAT SINK – 25 IN² MIN.

OUTPUT HEAT SINK – 1°C/W PER OUTPUT TRANSISTOR

SET IDLING CURRENT FOR 150 – 200 mA THROUGH 2-A FUSE.

Fig. 6 – 100-W dc-coupled audio amplifier circuit featuring parallel output transistors.



OUTPUT HEAT SINK – 1°C/W PER OUTPUT TRANSISTOR

SET IDLING CURRENT FOR 150 – 200 mA THROUGH 2-A FUSE.

NOTES:

1. All resistors 1/2 W, 5% carbon unless specified.
2. All capacitances in μF unless specified.
3. All resistors are non-inductive.
4. K-1 Relay, single-pole, single-throw, normally closed, with 24 V, 3 mA coil.
5. TSS1 - 70°C thermal cutout, Elmwood Sensor Part No. 3450-157-37, or equivalent.

Fig. 7 – 100-W ac-coupled audio amplifier circuit featuring parallel output transistors.

NOTE:

Power Transformer: Signal BO-8 (Signal Transformer Co., 1 Junius St., Brooklyn, N.Y. 11212), or equivalent.

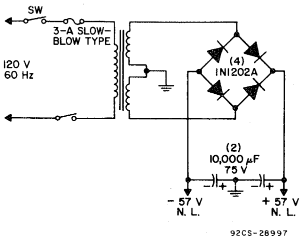


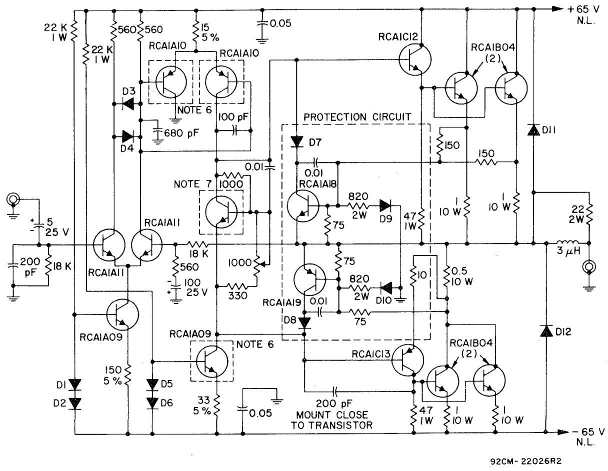
Fig. 8 – Power supply for 100-W audio amplifiers shown in Figs. 6 and 7.

120-W Amplifier

The 120-W amplifier shown in Fig. 9 uses four RCA1B04 transistors as parallel units in the amplifier output stages, and operates on a 130-V split power supply.

This 120-W amplifier is especially designed for top-of-the line quadrasonic use in applications requiring 1/2 kW of quadrasonic sound with excellent tonal quality. The amplifier output is directly coupled to an 8-Ω speaker.

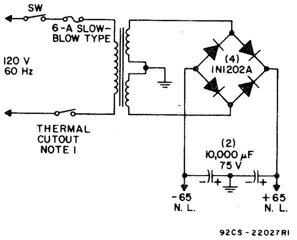
RCA1B04, RCA1B05, RCA1B09



NOTES:

1. D1-D8 – 1N5391; D9,D10 – 1N914B; D11, D12 – 1N5393
2. Resistors are 1/2 W ± 10% unless otherwise specified; values are in ohms
3. Capacitances are in µF unless otherwise specified.
4. Non-inductive resistors
5. Provide approx. 1°C/W heat sinking per output device based on mounting with mica washer and ZnO thermal compound (Dow Corning No.340, or equivalent) with $T_A = 45°C$ max.
6. Mount on heat sink, Wakefield No. 209-AB, or equivalent. (Alternatively, this type may be obtained with a factory-attached integral heat sink).
7. Attach heat sink cap (Wakefield No.260-6SH5E, or equivalent) on device and mount on same heat sink with output transistor.

Fig. 9 — 120-W audio-amplifier circuit featuring parallel output transistors.



NOTES:

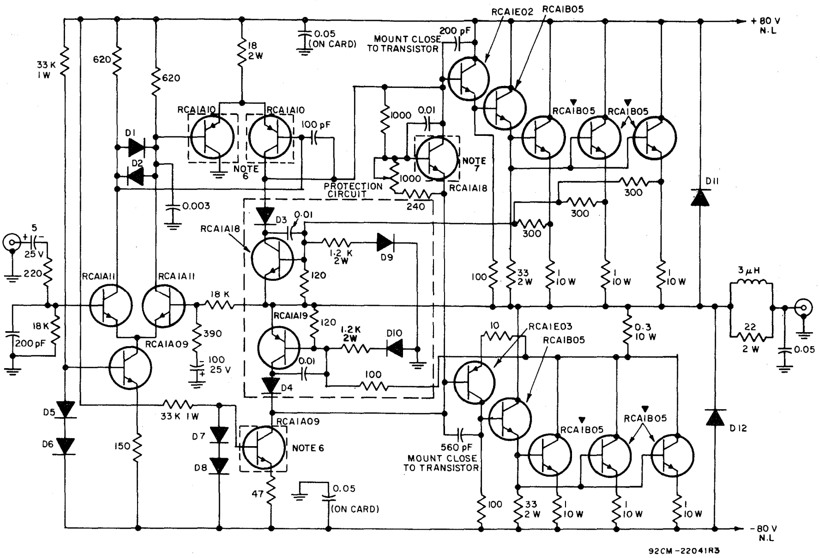
1. 93°C thermal cutout (attached to heat sink for output transistors (Elmwood Sensor part No. 2455-88-4), or equivalent.
2. Power transformer: Signal 88-6, Signal Transformer Co., 1 Junius St., Brooklyn, N.Y. 11212, or equivalent.
   Use 125-V primary tap.

Fig. 10 — Power supply for 120-W audio amplifier circuit shown in Fig. 9.

200-W Amplifier

The 200-W amplifier shown in Fig. 11 uses eight RCA 1B05 transistors, two as drivers and six as parallel units in the amplifier output stages, and operates on a 160-V split power supply.

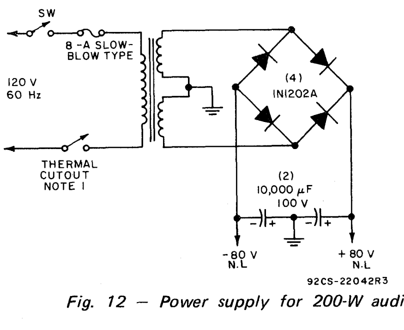
This 200-W amplifier is especially designed to feature ruggedness in combination with high power output and excellent high fidelity performance. The amplifier output is directly coupled to an 8-Ω speaker.



NOTES:

1. D1-D8 – 1N5391; D9, D10 – 1N5316; D11, D12 – 1N5393.
2. Resistors are 1/2W ± 10% unless otherwise specified, values are in ohms.
3. Capacitances are in μF unless otherwise specified.
4. Non-inductive resistors.
5. ▼ Provide approx. 1°C/W heat sinking per output device based on mounting with mica washer and ZnO thermal compound (Dow Corning No. 340, or equivalent) with T_A = 45°C max.
6. Mount on heat sink, Wakefield No. 209-AB, or equivalent. (Alternately, this type may be obtained with a factory-attached integral heat sink.)
7. Attach heat sink cap (Wakefield No. 260-6SHSE, or equivalent) on device and mount on same heat sink with output transistor.

Fig. 11 – 200-W audio amplifier circuit featuring paralle output transistors.



NOTES:

1. 90°C thermal cutout attached to heat sink for output transistors.
2. Power transformer: Signal 120-8 (Signal Transformer Co., 1 Junius St., Brooklyn, N.Y. 11212), or equivalent. Use 125-V primary tap.

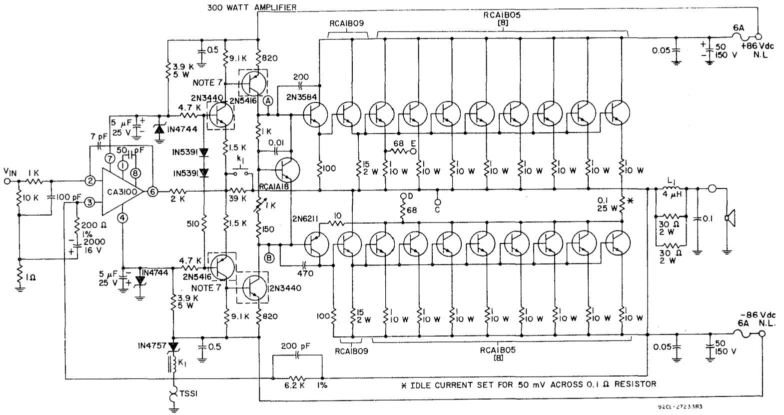
Fig. 12 – Power supply for 200-W audio amplifier circuit shown in Fig. 11.

300-W Amplifier

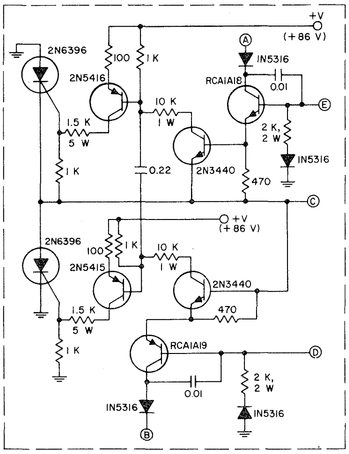
The 300-W amplifier shown in Fig. 13 uses two RCA1B09 transistors as drivers and sixteen RCA1B05 transistors as parallel units in the amplifier output stages, and operates on a 172-V split power supply.

This 300-W amplifier is conservatively designed to provide excellent high-power performance into either 8-Ω or 4-Ω loads. With the exception of the RCA-CA3100 linear integrated circuit for the front end, this amplifier is entirely push-pull for improved high-frequency distortion and slew rate. Additional circuit features include new thermal overload and reactive overload protection and instant turn-on with no undesirable transients.

RCA1B04, RCA1B05, RCA1B09



(a)

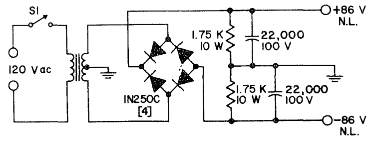


NOTES:

1. All resistors 1/2 W, 5% carbon unless specified.
2. All capacitances in microfarads unless specified.
3. All resistors are non-inductive.
4. K1-Relay, single-pole, single-throw, normally closed, with 24-V, 3 mA coil.
5. TSS1-70°C thermal cutout, Elmwood Sensor Part No. 3450-157-37, or equivalent.
6. For dc-coupled version, delete 2,000-μF capacitor, add 10-kΩ potentiometer – see 100-W amplifier circuit Fig.9 (a).
7. Common heat sink – 25 in.^{2} minimum.

(b)

Fig. 13 – 300-W audio amplifier circuit featuring parallel output transistors: (a) basic amplifier circuit, (b) protection circuit.



POWER TRANSFORMER SIGNAL 120-20
(SIGNAL TRANSFORMER CO., JANIUS ST.,
BROOKLYN, N.Y. 11212), OR EQUIVALENT
S1-20-A CIRCUIT BREAKER

Fig. 14 – Power supply for 300-W audio-amplifier circuit shown in Fig. 13.

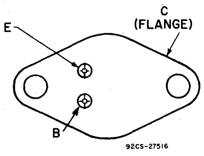
RCA1B06

Silicon Transistor for 70-Watt Quasi-Complementary-Symmetry Audio Amplifiers with Pi-Nu Output Transistors

RCA1B06 is an n-p-n pi-nu silicon transistor in a JEDEC TO-3 package. This device is especially characterized for audio-amplifier applications, and can be driven by either RCA1C03 or RCA1C04, n-p-n and p-n-p types, respectively.

The 40-watt amplifier shown in Fig. 3 uses the RCA1B06 output device in conjunction with eleven other discrete transistors, thirteen diodes, and a 90-volt split power supply. The amplifier output is directly coupled to an 8-ohm speaker. The high-frequency RCA1B06 output transistors used in the amplifier circuit produce excellent transient response at a high power level.

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		RCA1B06	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	120	V
COLLECTOR-TO-EMITTER VOLTAGE:			
With base open	V_{CEO}	100	V
With external base-to-emitter resistance (R_{BE}) = 100Ω	V_{CER}	120	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	6	V
COLLECTOR CURRENT	I_C	7	A
BASE CURRENT	I_B	2	A
TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 25°C		150	W
At case temperatures above 25°C		Derate linearly to 200°C	
TEMPERATURE RANGE:			
Storage & Operating (Junction)		−65 to 200	°C
PIN TEMPERATURE (During Soldering):			
At distances ≥ 1/32 in. (0.8 mm) from case for 10 s max.		230	°C

Type RCA1B06
Package: JEDEC TO-3
Construction: Silicon n-p-n, epitaxial, multiple-emitter-site, pi-nu

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = 90 V, R_{BE} = 100Ω	–	1	mA
V_{CEO}	I_C = 0.2 A, I_B = 0	100	–	V
f_T	I_C = 0.2 A, V_{CE} = 10 V	5	–	MHz
h_{FE}	I_C = 4 A, V_{CE} = 4 V	10	50	
V_{CE}(sat)	I_C = 4 A, I_B = 0.8 A	–	2	V
V_{BE}	I_C = 4 A, V_{CE} = 4 V	–	2	V
$I_{S/b}$	V_{CE} = 80 V, t = 1 s	1.87	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N5840

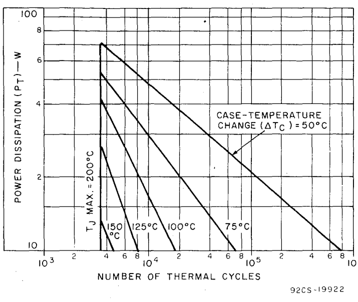


Fig. 2 – Thermal-cycling ratings for RCA1B06.

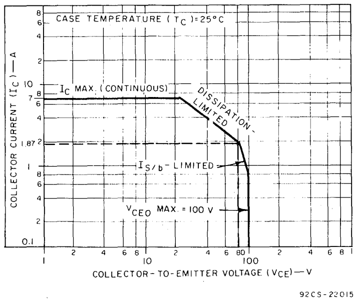
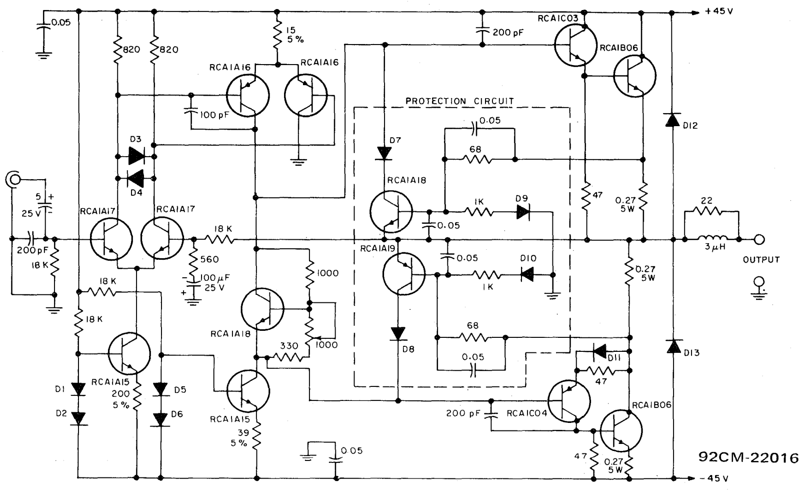


Fig. 3 – Maximum operating areas for RCA1B06.



NOTES:
1. 100°C thermal cutout attached to heat sink for output transistors (Elmwood Sensor part No. 2455-88-4).•
2. Power transformer: Signal 120-2 (parallel secondary),• Signal Transformer Co., 1 Junius St., Brooklyn, N.Y. 11212.
3. Resistors are 1/2-watt unless otherwise specified; values are in ohms.
4. Capacitances are in μF unless otherwise specified.
5. Non-inductive resistors.
6. D1-D8, D11-1N5391
D9, D10, D12, D13-1N5393

• Or equivalent.

Fig. 1 – 70-Watt amplifier circuit featuring quasi-complementary-symmetry output employing pi-nu construction outpu *transistors.*

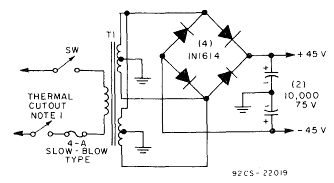


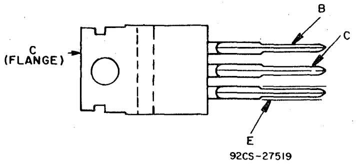
Fig. 4 – Power supply for 70-watt audio-amplifier shown in Fig. 3.

RCA1C03, RCA1C04, RCA1C12, RCA1C13

Silicon Transistors for Audio-Frequency Linear-Amplifier Applications

RCA1C03, RCA1C04, RCA1C12, and RCA1C13 are complementary silicon n-p-n and p-n-p transistors especially characterized for audio-amplifier applications. These devices, singly or in pairs in complementary- or quasi-complementary-symmetry circuits, are particularly useful as drivers or pre-drivers. They may also be used in audio power amplifiers, linear modulators, servo amplifiers, and operational amplifiers. The units are supplied in the JEDEC TO-220AB version of the plastic VERSAWATT package.

TERMINAL DESIGNATIONS



JEDEC TO-220AB

N-P-N Types	P-N-P Types
RCA1C03	RCA1C04
RCA1C12	RCA1C13

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		RCA1C03	RCA1C04	RCA1C12	RCA1C13	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	120	−120	140	−140	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:						
With base open	V_{CEO}	100	−100	120	−120	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	V_{CER}	120	−120	140	−140	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	−5	5	−5	V
CONTINUOUS COLLECTOR CURRENT	I_C	4	−4	4	−4	A
CONTINUOUS BASE CURRENT	I_B	2	−2	2	−2	A
TRANSISTOR DISSIPATION:	P_T					
At case temperatures up to 25°C		40	40	40	40	W
At case temperatures above 25°C		← Derate linearly to 150°C →				
TEMPERATURE RANGE:						
Storage and Operating (Junction)		← −65 to +150 →				°C
PIN TEMPERATURE (During Soldering):						
At distances ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max.		← 230 →				°C

Type RCA1C03
Package: JEDEC TO-220AB
Construction: Silicon n-p-n, epitaxial

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = 110 V, R_{BE} = 100Ω	–	1	mA
I_{EBO}	V_{EB} = 5 V, I_C = 0	–	1	mA
V_{CEO}	I_C = 0.1 A, I_B = 0	100	–	V
f_T	I_C = 0.5 A, V_{CE} = 4 V	4	–	MHz
h_{FE}	I_C = 1 A, V_{CE} = 4 V	50	250	
V_{CE}(sat)	I_C = 1 A, I_B = 0.1 A	–	1	V
V_{BE}	I_C = 1 A, V_{CE} = 4 V	–	1.5	V
$I_{S/b}$	V_{CE} = 40 V, t = 0.4 s	1	–	A

For charachersistics curves and test conditions, refer to published data for prototype 2N6293.

Type RCA1C04
Package: JEDEC TO-220AB
Construction: Silicon p-n-p, epitaxial

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = −110 V, R_{BE} = 100Ω	–	−1	mA
I_{EBO}	V_{EB} = −5 V, I_C = 0	–	−1	mA
V_{CEO}	I_C = −0.1 A, I_B = 0	−100	–	V
f_T	I_C = −0.5 A, V_{CE} = −4 V	10	–	MHz
h_{FE}	I_C = −1 A, V_{CE} = −4 V	50	250	
V_{CE}(sat)	I_C = −1 A, I_B = −0.1 A	–	−1	V
V_{BE}	I_C = −1 A, V_{CE} = −4 V	–	−1.5	V
$I_{S/b}$	V_{CE} = −40 V, t = 0.4 s	−1	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N6476.

Type RCA1C12
Package: JEDEC TO-220AB
Construction: Silicon n-p-n, epitaxial

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = 90 V, R_{BE} = 100 Ω	–	100	μA
I_{EBO}	V_{EB} = 5 V, I_C = 0	–	1	mA
V_{CEO}	I_C = 0.1 A, I_B = 0	120	–	V
V_{CER}	I_C = 0.1 A, R_{BE} = 100 Ω	140	–	V
f_T	I_C = 0.5 A, V_{CE} = 4 V	4	–	MHz
h_{FE}	I_C = 1 A, V_{CE} = 2 V	40	250	
V_{BE}	I_C = 1 A, V_{CE} = 2 V	–	1.2	V
$I_{S/b}$	V_{CE} = 60 V, t = 0.4 s	0.66	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N6474.

Type RCA1C13
Package: JEDEC TO-220AB
Construction: Silicon p-n-p, epitaxial

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = −90 V, R_{BE} = 100 Ω	–	−100	μA
I_{EBO}	V_{EB} = −5 V, I_C = 0	–	−1	mA
V_{CEO}	I_C = −0.1 A, I_B = 0	−120	–	V
V_{CER}	I_C = −0.1 A, R_{BE} = 100 Ω	−140	–	V
f_T	I_C = −0.5 A, V_{CE} = −4 V	10	–	MHz
h_{FE}	I_C = −1 A, V_{CE} = −2 V	40	250	
V_{BE}	I_C = −1 A, V_{CE} = −2 V	–	−1.2	V
$I_{S/b}$	V_{CE} = −60 V, t = 0.4 s	−0.66	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N6476.

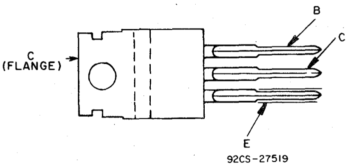
RCA1C05, RCA1C06

Silicon Transistors for 25-Watt Full-Complementary-Symmetry Audio Amplifiers

RCA1C05 and RCA1C06 are n-p-n and p-n-p epitaxial-base silicon power transistors, respectively. These complementary output devices for audio applications are provided in the JEDEC TO-220AB plastic package.

The 25-watt audio-amplifier circuit shown in Fig. 4 uses RCA1C05 and RCA1C06 as output devices in conjunction with seven TO-39 discrete transistors, ten diodes, and a 52-volt split power supply. The amplifier output is directly coupled to an 8-ohm speaker. The full-complementary-symmetry output stage provides excellent high-frequency performance at moderate cost.

TERMINAL DESIGNATIONS



JEDEC TO-220AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		RCA1C05	RCA1C06	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	60	–60	V
COLLECTOR-TO- EMITTER VOLTAGE:				
With base open	V_{CEO}	50	–50	V
With external base-to-emitter resistance (R_{BE}) = 100Ω	V_{CER}	60	–60	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	–5	V
COLLECTOR CURRENT	I_C	7	–7	A
BASE CURRENT	I_B	3	–3	A
TRANSISTOR DISSIPATION:	P_T			
At case temperatures up to 25°C		40	40	W
At case temperatures above 25°C		Derate linearly to 150°C		
TEMPERATURE RANGE:				
Storage & Operating (Junction)		–65 to +150		°C
PIN TEMPERATURE (During Soldering):				
At distances ≥1/32 in. (0.8 mm) from case of 10 s max.		230		°C

Type RCA1C05
Package: JEDEC TO-220AB
Construction: Silicon n-p-n, epitaxial base

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = 50 V, R_{BE} = 100Ω	–	1	mA
I_{EBO}	V_{BE} = 5 V, I_C = 0	–	1	mA
V_{CER}	I_C = 0.1 A, R_{BE} = 100Ω	60	–	V
f_T	I_C = 0.1 A, V_{CE} = 4 V	4	–	MHz
h_{FE}	I_C = 3 A, V_{CE} = 4 V	20	120	
V_{CE}(sat)	I_C = 3 A, I_B = 0.3 A	–	1	V
V_{BE}	I_C = 3 A, V_{CE} = 4 V	–	1.5	V
$I_{S/b}$	V_{CE} = 20 V, t = 0.5 s	2	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N6292

Type RCA1C06
Package: JEDEC TO-220AB
Construction: Silicon p-n-p, epitaxial base

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = –50 V, R_{BE} = 100Ω	–	–1	mA
I_{EBO}	V_{EB} = –5 V, I_C = 0	–	–1	mA
V_{CER}	I_C = –0.1 A, R_{BE} = 100Ω	–60	–	V
f_T	I_C = –0.1 A, V_{CE} = –4 V	10	–	MHz
h_{FE}	I_C = –3 A, V_{CE} = –4 V	20	120	
V_{CE}(sat)	I_C = –3 A, I_B = –0.3 A	–	–1	V
V_{BE}	I_C = –3 A, V_{CE} = –4 V	–	–1.5	V
$I_{S/b}$	V_{CE} = –20 V, t = 0.5 s	–2	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N6107 (File 488).

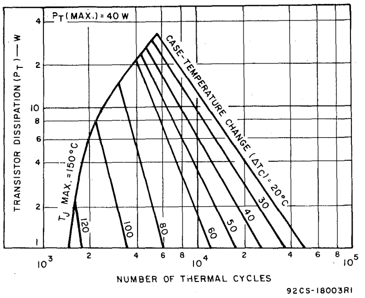


Fig. 1 – Thermal-cycling ratings for RCA1C05 and RCA1C06.

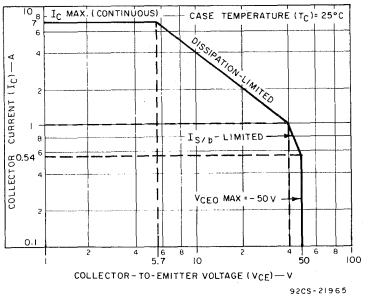


Fig. 2 – Maximum operating areas for RCA1C05.

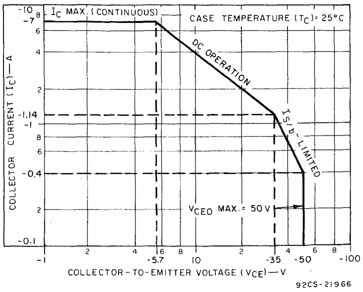
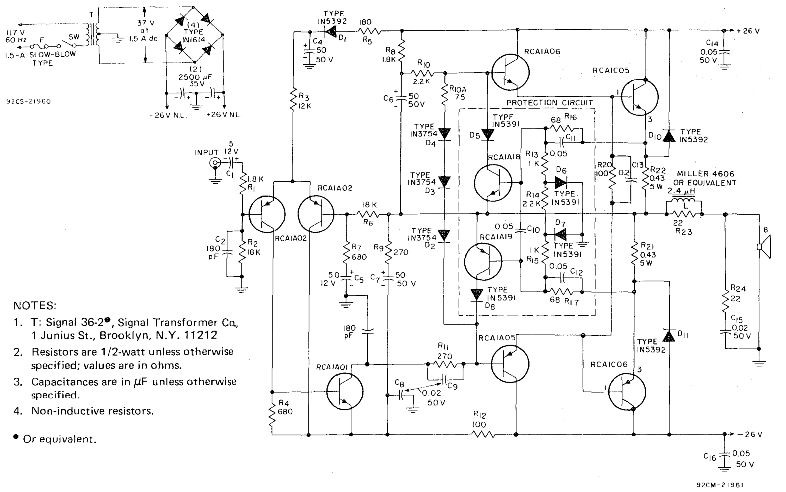


Fig. 3 – Maximum operating areas for RCA1C06.

RCA1C05, RCA1C06



NOTES:

1. T: Signal 36-2●, Signal Transformer Co., 1 Junius St., Brooklyn, N.Y. 11212
2. Resistors are 1/2-watt unless otherwise specified; values are in ohms.
3. Capacitances are in μF unless otherwise specified.
4. Non-inductive resistors.

● Or equivalent.

Fig. 4 — 25-watt amplifier circuit featuring true-complementary-symmetry output with load line limiting.

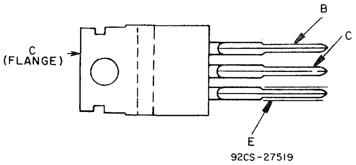
RCA1C07, RCA1C08

Silicon Transistors for 40-Watt Full-Complementary-Symmetry Audio Amplifiers

RCA1C07 and RCA1C08 are n-p-n and p-n-p epitaxial-base silicon power transistors, respectively, especially suitable for audio-output applications. These devices are provided in the economical JEDEC TO-220AB version of the VERSAWATT package.

The 40-watt amplifier shown in Fig. 4 uses the RCA1C07 and RCA1C08 in conjunction with seven TO-39 transistors, ten diodes, and a 64-volt split power supply. The amplifier output is directly coupled to an 8-ohm speaker. The high-frequency performance of this 40-watt amplifier will provide excellent reproduction for the most critical listener.

TERMINAL DESIGNATIONS



JEDEC TO-220AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		RCA1C07	RCA1C08	
COLLECTOR-TO-BASE-VOLTAGE	V_{CBO}	75	–75	V
COLLECTOR-TO-EMITTER VOLTAGE:				
With base open	V_{CEO}	65	–65	V
With external base-to-emitter resistance (R_{BE}) = 100Ω	V_{CER}	75	–75	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	–5	V
COLLECTOR CURRENT	I_C	10	–10	A
BASE CURRENT	I_B	4	–4	A
TRANSISTOR DISSIPATION:	P_T			
At case temperatures up to 25°C		75	75	W
At case temperatures above 25°C		Derate linearly to 150°C		
TEMPERATURE RANGE:				
Storage & Operating (Junction)		◄— –65 to 150 —►		°C
PIN TEMPERATURE (During Soldering):				
At distances ≥1/32 in. (0.8 mm) from case for 10 s max.		◄— 230 —►		°C

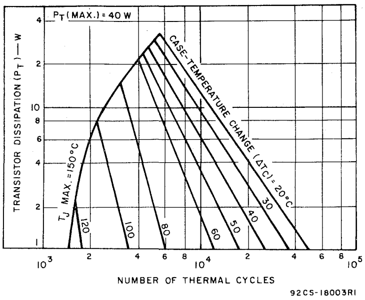


Fig. 1 — Thermal-cycling ratings for RCA1C07 and RCA1C08.

Type RCA1C07
Package: JEDEC TO-220AB
Construction: Silicon n-p-n, epitaxial base

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = 65V, R_{BE} = 100Ω	–	1	mA
I_{EBO}	V_{BE} = 5V, I_C = 0	–	1	mA
V_{CER}	I_C = 0.1A, R_{BE} = 100Ω	75	–	V
f_T	I_C = 1 A, V_{CE} = 4V	5	–	MHz
h_{FE}	I_C = 4A, V_{CE} = 4V	20	120	
V_{CE}(sat)	I_C = 4A, I_B = 0.4 A	–	1	V
V_{BE}	I_C = 4A, V_{CE} = 4V	–	1.5	V
$I_{S/b}$	V_{CE} = 30V, t = 0.5 s	2.5	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N6292

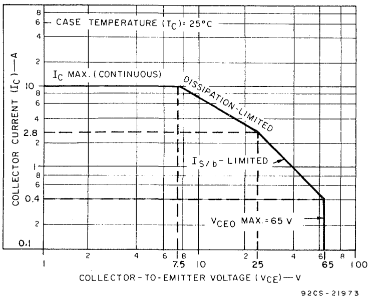


Fig. 2 — Maximum operating areas for RCA1C07.

Type RCA1C08
Package: JEDEC TO-220AB
Construction: Silicon p-n-p, epitaxial base

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = –65V, R_{BE} = 100Ω	–	–1	mA
I_{EBO}	V_{EB} = –5V, I_C = 0	–	–1	mA
V_{CER}	I_C = –0.1A, R_{BE} = 100Ω	–75	–	V
f_T	I_C = –1 A, V_{CE} = –4V	5	–	MHz
h_{FE}	I_C = –4A, V_{CE} = –4V	20	120	
V_{CE}(sat)	I_C = –4A, I_B = –0.4A	–	–1	V
V_{BE}	I_C = –4A, V_{CE} = –4V	–	–1.5	V
$I_{S/b}$	V_{CE} = –30V, t = 0.5 s	–2.5	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N6107 (File 488).

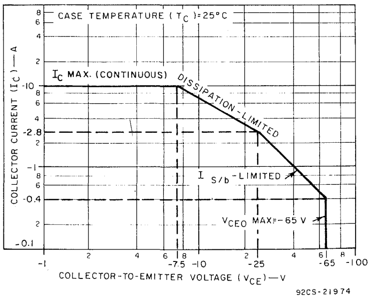
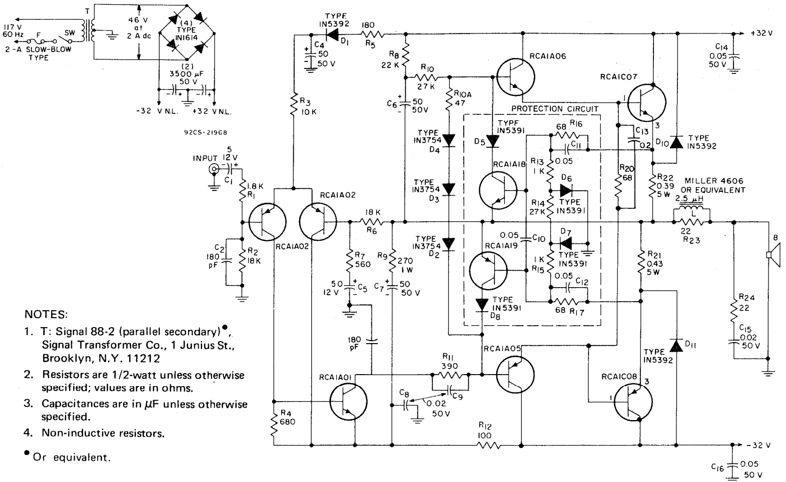


Fig. 3 — Maximum operating areas for RCA1C08.

RCA1C07, RCA1C08



NOTES:

1. T: Signal 88-2 (parallel secondary)●, Signal Transformer Co., 1 Junius St., Brooklyn, N.Y. 11212
2. Resistors are 1/2-watt unless otherwise specified; values are in ohms.
3. Capacitances are in µF unless otherwise specified.
4. Non-inductive resistors.

● Or equivalent.

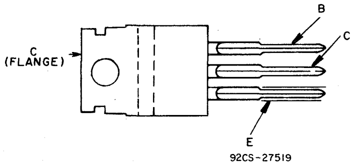
Fig. 4 — 40-Watt amplifier circuit featuring full-complementary-symmetry output using load line limiting.

Silicon Transistor for 40-Watt Quasi-Complementary-Symmetry Audio Amplifiers

RCA1C09 is an n-p-n, hometaxial-base silicon transistor packaged in the JEDEC TO-220AB (VERSAWATT) case. Two of these devices, driven in the class-B mode by the RCA1A06 and RCA1A05 silicon n-p-n and p-n-p transistors, can be used as output devices in audio-amplifier applications.

The 40-watt amplifier shown in Fig. 3 uses two RCA1C09 transistors as output units in conjunction with seven TO-39 transistors, 11 diodes, and a 64-volt split power supply. The amplifier output is directly coupled to an 8-ohm speaker. This 40-watt amplifier features ruggedness and economy in the mid-power range.

TERMINAL DESIGNATIONS



JEDEC TO-220AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		RCA1C09	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	75	V
COLLECTOR-TO-EMITTER VOLTAGE:			
With base open	V_{CEO}	65	V
With external base-to-emitter resistance (R_{BE}) = 100Ω	V_{CER}	75	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	V
COLLECTOR CURRENT	I_C	10	A
BASE CURRENT	I_B	4	A
TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 25°C		75	W
At case temperatures above 25°C		Derate linearly to 150°C	
TEMPERATURE RANGE:			
Storage & Operating (Junction)		−65 to 150	°C
PIN TEMPERATURE (During Soldering):			
At distances ≥1/32 in. (0.8 mm) from case for 10 s max.		230	°C

Type RCA1C09
Package: JEDEC TO-220AB
Construction: Silicon n-p-n, hometaxial base

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = 65 V, R_{BE} = 100Ω	–	1	mA
I_{EBO}	V_{EB} = 5 V, I_C = 0	–	1	mA
V_{CER}	I_C = 0.2 A, R_{BE} = 100Ω	75	–	V
f_T	I_C = 0.5 A, V_{CE} = 4 V	0.8	–	MHz
h_{FE}	I_C = 4 A, V_{CE} = 4 V	20	120	
$V_{CE}(sat)$	I_C = 4 A, I_B = 0.4 A	–	1	V
V_{BE}	I_C = 4 A, V_{CE} = 4 V	–	1.5	V
$I_{S/b}$	V_{CE} = 40 V, t = 0.5 s	1.87	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N6103

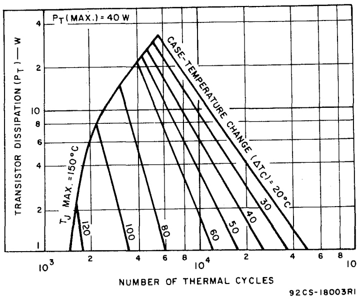
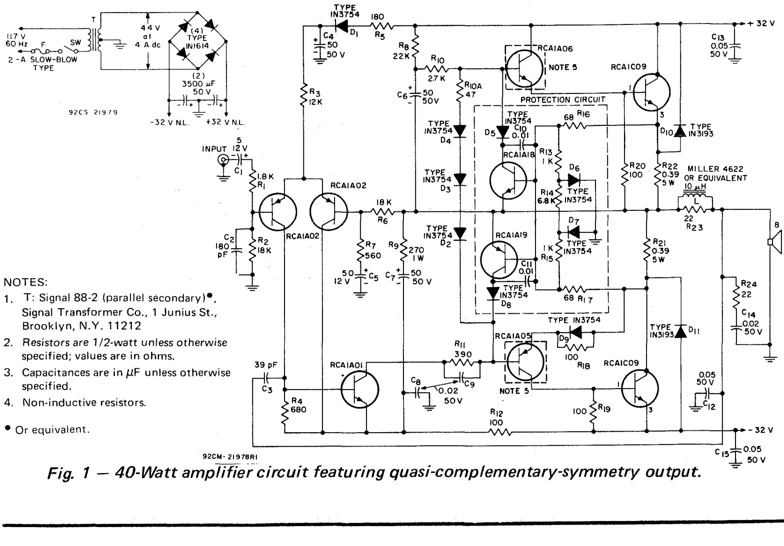


Fig. 2 — Thermal-cycling ratings for RCA1C09.



NOTES:
1. T: Signal 88-2 (parallel secondary)•, Signal Transformer Co., 1 Junius St., Brooklyn, N.Y. 11212
2. Resistors are 1/2-watt unless otherwise specified; values are in ohms.
3. Capacitances are in μF unless otherwise specified.
4. Non-inductive resistors.

• Or equivalent.

Fig. 1 — 40-Watt amplifier circuit featuring quasi-complementary-symmetry output.

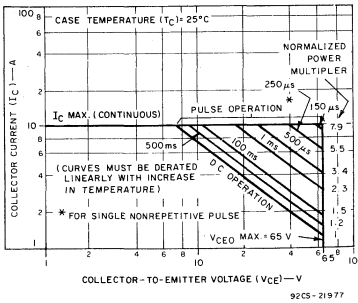


Fig. 3 — Maximum operating areas for RCA1C09.

RCA1C10, RCA1C11

Silicon Transistors for 12-Watt True-Complementary-Symmetry Audio Amplifiers

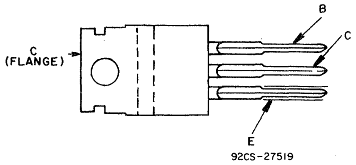
RCA1C10 and RCA1C11 are n-p-n and p-n-p epitaxial-base silicon power transistors, respectively, especially characterized for audio-output service. To enhance circuit economics, they are provided in the JEDEC TO-220AB version of the VERSAWATT plastic package.

The 12-watt audio amplifier circuit shown in Fig. 4 uses RCA1C10 and RCA1C11 as output devices in conjunction with three discrete transistors, two diodes, and a single 36-volt power supply; the amplifier output is capacitively coupled to an 8-ohm speaker. The choice of a true-complementary-symmetry output stage provides excellent fidelity for a low-cost system.

The 12-watt amplifier circuit shown in Fig. 5 uses RCA1C10 and RCA1C11 discrete transistors, an integrated circuit, one diode, and a 36-volt split power supply; the amplifier output is directly coupled to an 8-ohm speaker. The integrated circuit-true-complementary-symmetry combination provides a high-quality, low-cost amplifier.

The RCA CA3094AT integrated circuit provides sufficient drive current for the complementary-symmetry output stage. Tone controls, bass and treble, with functions of "boost" and "cut" are incorporated into the feedback loop of the amplifier, resulting in excellent signal-to-noise ratio and freedom from distortion. Ratings and characteristics of type CA3094AT are given in RCA data bulletin File 598.

TERMINAL DESIGNATIONS



JEDEC TO-220AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		RCA1C10	RCA1C11	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	40	−40	V
COLLECTOR-TO-EMITTER VOLTAGE:				
With base open	V_{CEO}	40	−40	V
With external base-to-emitter resistance (R_{BE}) = 100Ω	V_{CER}	50	−50	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	−5	V
COLLECTOR CURRENT	I_C	7	−7	A
BASE CURRENT	I_B	3	−3	A
TRANSISTOR DISSIPATION:	P_T			
At case temperatures up to 25°C		40	40	W
At case temperatures above 25°C		Derate linearly to 150°C		
TEMPERATURE RANGE:				
Storage & Operating (Junction)		← −65 to 150 →		°C
PIN TEMPERATURE (During Soldering):				
At distances ≥1/32 in. (0.8 mm) from case for 10 s max.		← 230 →		°C

Type RCA1C10
Package: JEDEC TO-220AB
Construction: Silicon n-p-n, epitaxial-base

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = 35 V, R_{BE} = 100Ω	–	10	μA
I_{EBO}	V_{EB} = 5 V	–	1	mA
V_{CEO}	I_C = 0.1 A, I_B = 0	40	–	V
V_{CER}	I_C = 0.1 A, R_{BE} = 100Ω	50	–	V
f_T	V_{CE} = 4 V, I_C = 0.5 A	4	–	MHz
h_{FE}	I_C = 1.5 A, V_{CE} = 4 V	50	250	
$V_{CE}(sat)$	I_C = 1.5 A, I_B = 0.075 A	–	1	V
V_{BE}	I_C = 1.5 A, V_{CE} = 4 V	–	1.5	V
$I_{S/b}$	V_{CE} = 20 V, t = 0.4 s	2	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N6292

Type RCA1C11
Package: JEDEC TO-220AB
Construction: Silicon p-n-p, epitaxial base

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = −35 V, R_{BE} = 100Ω	–	−10	μA
I_{EBO}	V_{EB} = −5 V	–	−1	mA
V_{CEO}	I_C = −0.1 A, I_B = 0	−40	–	V
V_{CER}	I_C = −0.1 A, R_{BE} = 100Ω	−50	–	V
f_T	V_{CE} = −4 V, I_C = −0.5 A	10	–	MHz
h_{FE}	I_C = −1.5 A, V_{CE} = −4 V	50	250	
$V_{CE}(sat)$	I_C = −1.5 A, I_B = −0.075 A	–	−1	V
V_{BE}	I_C = −1.5 A, V_{CE} = −4 V	–	−1.5	V
$I_{S/b}$	V_{CE} = −20 V, t = 0.4 s	−2	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N6107

RCA1C10, RCA1C11

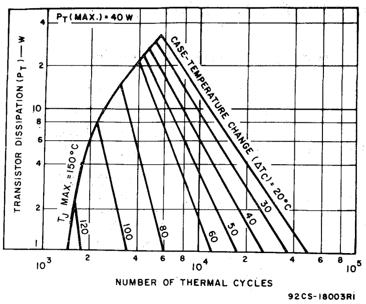


Fig. 1 – Thermal-cycling ratings for RCA1C10 and RCA1C11.

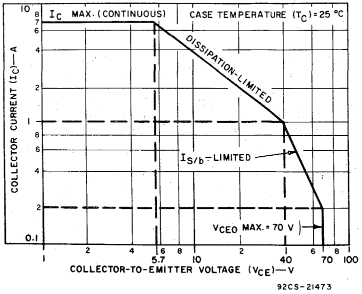


Fig. 2 – Maximum operating areas for RCA1C10.

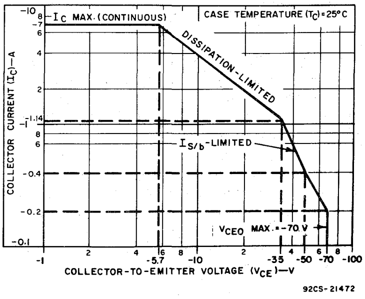
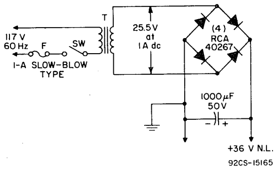


Fig. 3 – Maximum operating areas for RCA1C11.



NOTES:

1. T: Thordarson 23V118, Stancor TP4, Triad F-93X, or equivalent (for Stereo Amplifiers).
2. Resistors are 1/2-watt unless otherwise specified; values are in ohms.
3. Capacitances are in µF unless otherwise specified.
4. Non-inductive resistors.

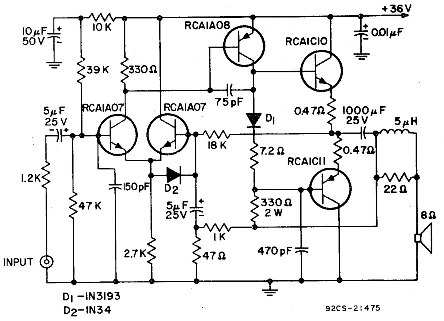
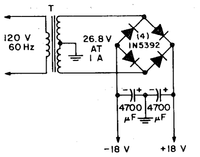
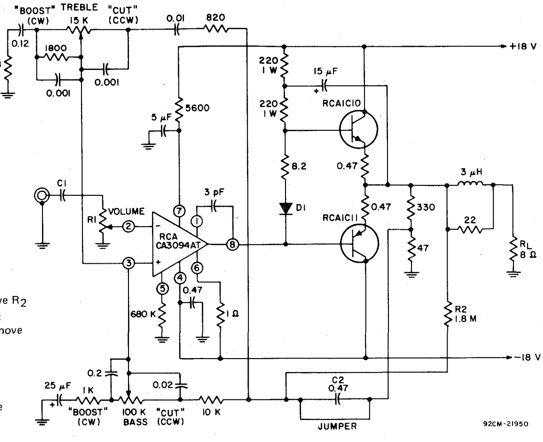


Fig. 4 – 12-watt amplifier circuit featuring complementary-symmetry output.





NOTES:

1. T: Stancor No.P-8609 (120 V AC to 26.8 V CT @ 1 A) or equivalent
2. FOR STANDARD INPUT: Short C_2; R_1 = 250 K; C_1 = 0.047 µF; Remove R_2
3. FOR CERAMIC-CARTRIDGE INPUT: C_1 = 0.0047 µF; R_1 = 2.5 MΩ; Remove Jumper from C_2; Leave R_2.
4. D1 1N5392
5. Resistors are 1/2-watt unless otherwise specified; values are in ohms.
6. Capacitances are in µF unless otherwise specified.
7. Non-inductive resistors.

Fig. 5 – 12-watt amplifier circuit featuring an integrated-circuit driver and a true-complementary-symmetry output stage.

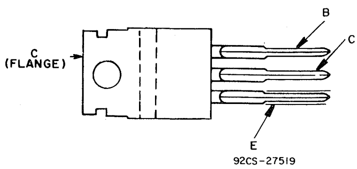
RCA1C14

Silicon Transistor for 25-Watt Quasi-Complementary-Symmetry Audio Amplifiers

RCA1C14 is an n-p-n hometaxial-base silicon power transistor provided in the JEDEC TO-220AB package. This device is ideally suited for use in the output stage of quasi-complementary-symmetry audio amplifiers

The 25-watt audio-amplifier circuit shown in Fig. 2 uses two RCA1C14 transistors in conjunction with seven TO-39 low-level audio transistors, 11 diodes, and a 52-volt split supply. The amplifier output is directly coupled to an 8-ohm speaker. Ruggedness and economy are features of this high fidelity amplifier.

TERMINAL DESIGNATIONS



JEDEC TO-220AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		RCA1C14	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	60	V
COLLECTOR-TO-EMITTER VOLTAGE:			
With base open	V_{CEO}	40	V
With external base-to-emitter resistance (R_{BE}) = 100Ω	V_{CER}	60	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	V
COLLECTOR CURRENT	I_C	7	A
BASE CURRENT	I_B	3	A
TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 25°C		50	W
At case temperatures above 25°C		Derate linearly to 150°C	
TEMPERATURE RANGE:			
Storage & Operating (Junction)		−65 to 150	°C
PIN TEMPERATURE (During Soldering):			
At distances ≥1/32 in. (0.8 mm) from case for 10 s max.		230	°C

Type RCA1C14
Package: JEDEC TO-220AB
Construction: Silicon n-p-n, hometaxial base

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = 50 V, R_{BE} = 100Ω	–	0.5	mA
I_{EBO}	V_{EB} = 5 V, I_C = 0	–	1	mA
V_{CEO}	I_C = 1 A, I_B = 0	40	–	V
V_{CER}	I_C = 0.1 A, R_{BE} = 100Ω	60	–	V
f_T	I_C = 0.5 A, V_{CE} = 4 V	0.8	–	MHz
h_{FE}	I_C = 3 A, V_{CE} = 4 V	20	70	
V_{CE}(sat)	I_C = 3 A, I_B = 0.3A	–	1	V
V_{BE}	I_C = 3 A, V_{CE} = 4 V	–	1.4	V
$I_{S/b}$	V_{CE} = 40 V, t=0.5 s	1.25	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N5495

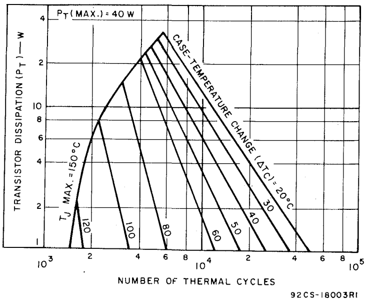


Fig. 1 — Thermal-cycling ratings for RCA1C14.

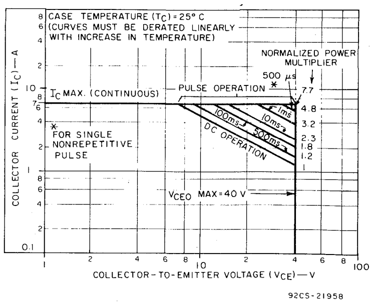
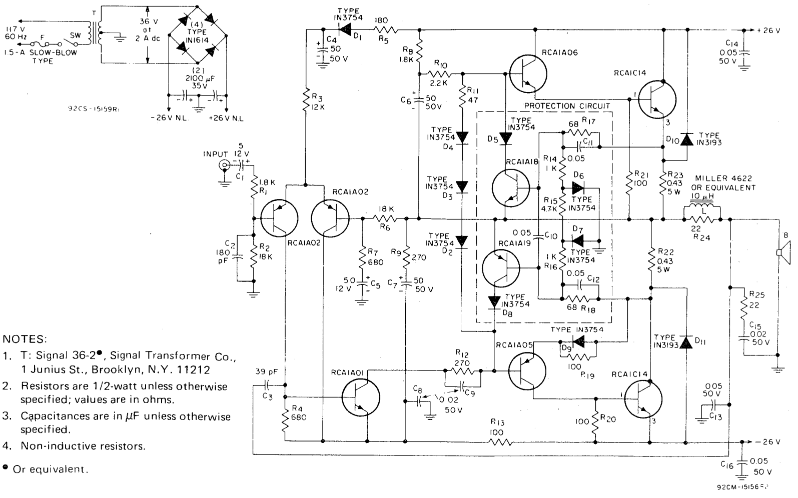


Fig. 3 — Maximum operating areas for RCA1C14.



NOTES:

1. T: Signal 36-2•, Signal Transformer Co., 1 Junius St., Brooklyn, N.Y. 11212
2. Resistors are 1/2-watt unless otherwise specified; values are in ohms.
3. Capacitances are in µF unless otherwise specified.
4. Non-inductive resistors.

• Or equivalent.

Fig. 2 — 25-watt amplifier circuit featuring quasi-complementary-symmetry output.

RCA1C15, RCA1C16

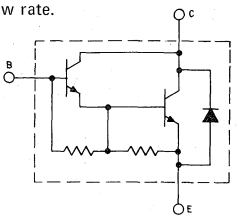
Silicon Transistors for 20-Watt Full-Complementary-Symmetry Audio Amplifiers with Darlington Output Transistors

The RCA1C15 and RCA1C16 are complementary silicon n-p-n and p-n-p Darlington transistors. They are especially suitable for use as output devices in audio applications. These transistors are provided in the economical JEDEC TO-220AB straight-lead version of the VERSAWATT package. Optional lead configurations are available upon request.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

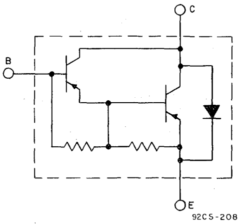
	RCA1C15	RCA1C16	
V_{CBO}	80	−80	V
V_{CEO}(sus)	80	−80	V
V_{CER}(sus) R_{BE} = 100 Ω	80	−80	V
V_{CEV}(sus) V_{BE}=1.5 V reverse bias	80	−80	V
V_{EBO}	5	−5	V
I_C	10	−10	A
I_{CM}	15	−15	A
I_B	0.25	−0.25	A
P_T			
At $T_C \leqslant 25^oC$	65	65	W
At $T_C > 25^oC$ derate linearly	—— 0.52 ——		W/^{o}C
T_{stg}, T_J	−65 to +150		^{o}C
T_L At distance ⩾ 1/32 in. (0.8 mm) from seating plane for 10 s max.	—— 235 ——		^{o}C

The 20-watt audio amplifier shown in Fig. 5 uses the RCA1C15 and RCA1C16 as output devices in conjunction with seven discrete transistors, eight diodes, and an integrated circuit. With the exception of the RCA CA3140B linear integrated circuit for the front end, this amplifier is entirely push-pull for improved high-frequency distortion and slew rate.



92CS-28597

Fig. 1 – Schematic diagram for RCA1C15.



92CS-20863R1

Fig. 2 – Schematic diagram for RCA1C16.

Type: RCA1C15, RCA1C16 Package: JEDEC TO-220

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25^{o}C, unless otherwise specified*

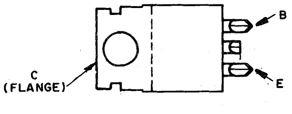
CHARACTERISTIC	TEST CONDITIONS●	LIMITS				UNITS
		RCA1C15*		RCA1C16**		
		Min.	Max.	Min.	Max.	
I_{CEO}	V_{CE} = 80 V, I_B = 0	–	1	–	−1	mA
I_{CEV}	V_{CE} = 80 V, V_{BE} = −1.5 V	–	0.3	–	−0.3	mA
T_C = 125^{o}C	V_{CE} = 80 V, V_{BE} = −1.5 V	–	3	–	−3	
I_{EBO}	V_{BE} = 5 V, I_C = 0	–	5	–	−10	mA
V_{CEO}(sus)	I_C = 0.2 A, I_B = 0	80	–	−80	–	V
V_{CER}(sus)	I_C = 0.2 A, R_{BE} = 100 Ω	80	–	−80	–	V
V_{CEV}(sus)	I_C = 0.2 A, V_{BE} = −1.5 V	80	–	−80	–	V
h_{FE}	I_C = 3 A, V_{CE} = 5 V	1000	20,000	1000	20,000	
V_{CE}(sat)	I_C = 5 A, I_B = 0.01 A	–	2	–	−2	V
V_{BE}	I_C = 3 A, V_{CE} = 5 V	–	2.8	–	−2.8	V
V_F	I_C = −10 A	–	4	–	4	V
$\|h_{fe}\|$	I_C = 1 A, V_{CE} = 5 V, f = 1 MHz	20	–	20	–	
$I_{S/b}$	V_{CE} = 25 V, t = 1 s	2.6	–	−2.6	–	A

● For RCA1C16, reverse polarity of voltage and current.

* For characteristics curves and test conditions, refer to published data for prototype 2N6388

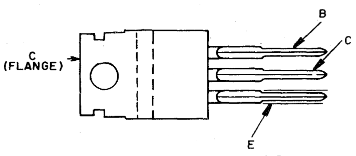
** For characteristics curves and test conditions, refer to published data for prototype RCA8203B

TERMINAL DESIGNATIONS



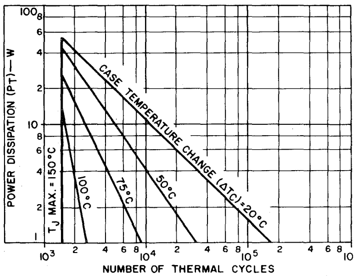
92CS-27520

JEDEC TO-220AA



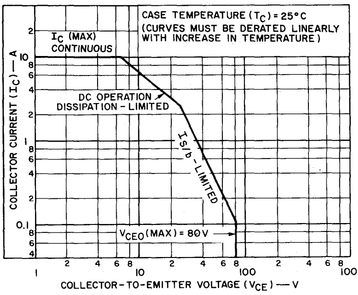
92CS-27519

JEDEC TO-220AB



92CS-26424

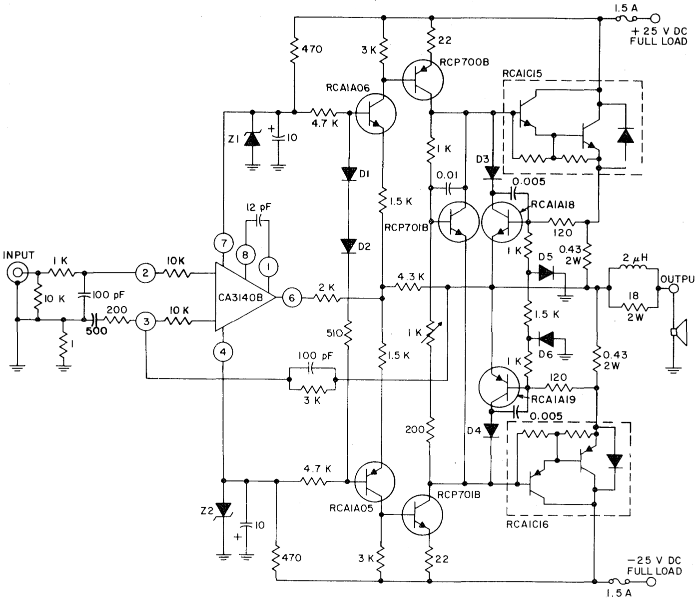
Fig. 3 – Thermal-cycling rating chart for both types.



92CS-29287

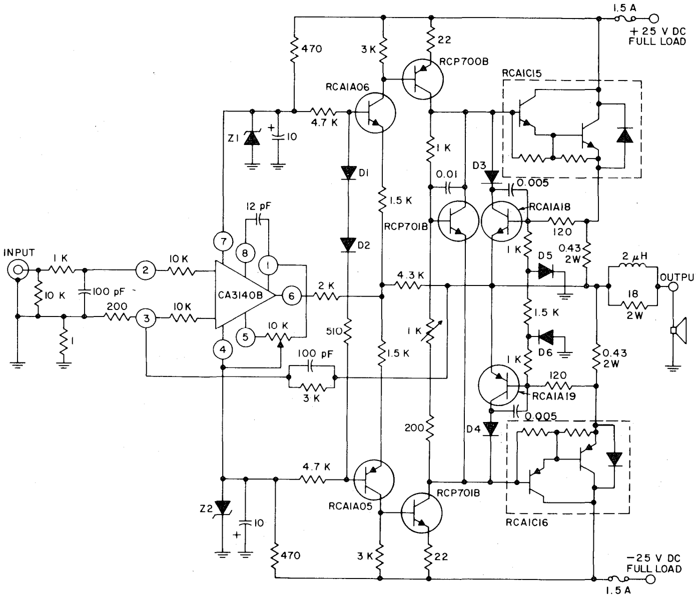
Fig. 4 – Maximum operating areas for both types.

RCA1C15, RCA1C16



(a) Amplifier with ac coupling

92CL-29288



(b) Amplifier with dc coupling

92CL-29289

NOTES:

1. D1–D2 = D1300A; D4–D6 = 1N914
2. Z1–Z2 = 1N4744
3. Resistors are 1/2-watt, ±10% unless otherwise specified; values are in ohms
4. Capacitances are in µF unless otherwise specified
5. Non-inductive resistors
6. Heat sink for output transistors should be 1.3°C/W (Wakefield No. 421, or equivalent)

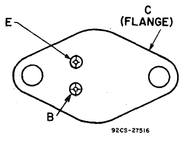
Fig. 5 – 20-watt audio-amplifier circuit featuring full-complementary-symmetry with Darlington output transistors.

RCA1E02, RCA1E03

Silicon Transistors for Audio-Frequency Linear-Amplifier Applications

RCA1E02 and RCA1E03 are silicon n-p-n and p-n-p transistors, respectively. These complementary devices are especially characterized for audio-amplifier applications. They may be used singly or as a complementary pair in complementary- or quasi-complementary-symmetry circuits, and are particularly useful as drivers or predrivers. They may also be used in audio power amplifiers, linear modulators, servo amplifiers, and operational amplifiers. The units are supplied in the JEDEC TO-66 package.

TERMINAL DESIGNATIONS



JEDEC TO-66

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		RCA1E02	RCA1E03	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	200	−200	V
COLLECTOR-TO-EMITTER VOLTAGE:				
With base open	V_{CEO}	175	−175	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	V_{CER}	200	−200	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	−5	V
COLLECTOR CURRENT	I_C	2	−2	A
BASE CURRENT	I_B	1	−1	A
TRANSISTOR DISSIPATION:	P_T			
At case temperatures up to 25°C		35	35	W
At case temperatures above 25°C		Derate linearly to 200°C		
TEMPERATURE RANGE:				
Storage and Operating (Junction)		← −65 to +200 →		°C
PIN TEMPERATURE (During Soldering):				
At distances ⩾ 1/32 in. (0.8 mm) from case for 10 s max.		← 230 →		°C

Type RCA1E02
Package: JEDEC TO-66
Construction: Silicon n-p-n

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = 120 V, R_{BE} = 100 Ω	–	100	μA
I_{EBO}	V_{EB} = 5 V, I_C = 0	–	1	mA
V_{CEO}	I_C = 0.1 A, I_B = 0	175	–	V
V_{CER}	I_C = 0.1 A, R_{BE} = 100 Ω	200	–	V
h_{FE}	I_C = 0.3 A, V_{CE} = 2 V	30	150	
V_{BE}	I_C = 0.3 A, V_{CE} = 2 V	–	1	V
$I_{S/b}$	V_{CE} = 80 V, t = 0.4 s	0.4	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N3583

Type RCA1E03
Package: JEDEC TO-66
Construction: Silicon p-n-p

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS
		MIN.	MAX.	
I_{CER}	V_{CE} = −120 V, R_{BE} = 100 Ω	–	−100	μA
I_{EBO}	V_{EB} = −5 V, I_C = 0	–	−1	mA
V_{CEO}	I_C = −0.1 A, I_B = 0	−175	–	V
V_{CER}	I_C = −0.1 A, R_{BE} = 100 Ω	−200	–	V
h_{FE}	I_C = −0.3 A, V_{CE} = −2 V	30	150	
V_{BE}	I_C = −0.3 A, V_{CE} = −2 V	–	−1	V
$I_{S/b}$	V_{CE} = −80 V, t = 0.4 s	−0.25	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N6211

RCA8203, RCA8203A, RCA8203B, RCA125, RCA126

8- and 10-Ampere P-N-P Darlington Power Transistors

40-60-80 Volts, 65 Watts
Gain of 1000 at 5 A (RCA8203A, RCA8203B)
Gain of 1000 at 3 A (RCA8203, RCA125, RCA126)
Gain of 500 at −0.75 A (RCA125, RCA126)

Features:

- Operates from IC without predriver
- High reverse second-breakdown capability

Applications:

- Power switching
- Hammer drivers
- Series and shunt regulators
- Audio amplifiers

These RCA devices are monolithic silicon p-n-p Darlington transistors designed for low- and medium-frequency power applications. The high gain of these devices makes it possible for them to be driven directly from integrated circuits.

The RCA8203, RCA8203A and RCA 8203B are complementary to the 2N6386, 2N6387, and 2N6388. Technical data for 2N6386 – 2N6388 are given in RCA Bulletin File No. 610.

The RCA125 and RCA126 are p-n-p complements of the RCA120 and RCA-121 described in File No. 840.

These devices are supplied in the JEDEC TO-220AB straight-lead version of the VERSAWATT package. Optional lead configurations are available upon request. For information, contact your nearest RCA Sales Office.

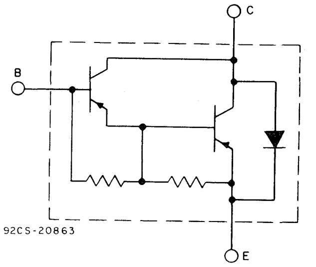
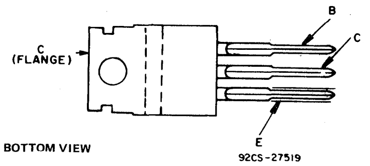


Fig. 1 – Schematic diagram for all types.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	RCA8203B	RCA8203A	RCA8203	RCA125	RCA126	
V_{CBO}	−80	−60	−40	−60	−80	V
$V_{CER}(sus)$						
$R_{BE} = 100\ \Omega$	−80	−60	−40	–	–	V
$V_{CEO}(sus)$	−80	−60	−40	−60	−80	V
$V_{CEV}(sus)$						
$V_{BE} = -1.5$ V	−80	−60	−40	–	–	V
V_{EBO}	−5	−5	−5	−5	−5	V
I_C	−10	−10	−8	−8	−8	A
I_{CM}	−15	−15	−15	−15	−15	A
I_B	−0.25	−0.25	−0.25	−0.25	−0.25	A
P_T						
$T_C \leqslant 25°C$	65	65	65	65	65	W
$T_C > 25°C$	Derate linearly to 150°C					
T_{stg}, T_J	−65 to +150					°C
T_L						
At distance ⩾1/8 in. (3.17 mm) from case for 20 s max.	235					°C

TERMINAL DESIGNATIONS



JEDEC TO-220AB

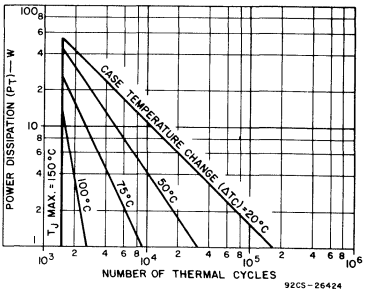


Fig. 2 - Thermal-cycling rating chart for all types.

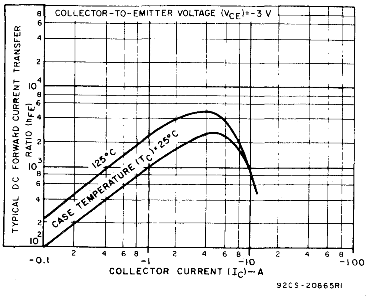


Fig. 3 - Typical dc beta characteristics for all types.

RCA8203, RCA8203A, RCA8203B, RCA125, RCA126

ELECTRICAL CHARACTERISTICS, *At Case Temperature, T_C = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS				LIMITS										UNITS
	VOLTAGE V dc		CURRENT A dc		RCA8203B		RCA8203A		RCA8203		RCA125		RCA126		
	V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
I_{CEO}	–80			0	–	–1	–	–	–	–	–	–	–	–	mA
	–60			0	–	–	–	–1	–	–	–	–	–	–	
	–40			0	–	–	–	–	–	–1	–	–	–	–0.5	
	–30			0	–	–	–	–	–	–	–	–0.5	–	–	
I_{CEV}	–80	1.5			–	–0.3	–	–	–	–	–	–	–	–	
	–60	1.5			–	–	–	–0.3	–	–	–	–	–	–	
	–40	1.5			–	–	–	–	–	–0.3	–	–	–	–	
T_C = 125°C	–80	1.5			–	–3	–	–	–	–	–	–	–	–	
	–60	1.5			–	–	–	–3	–	–	–	–	–	–	
	–40	1.5			–	–	–	–	–	–3	–	–	–	–	
I_{EBO}		5	0		–	–10	–	–10	–	–10	–	–10	–	–10	mA
V_{CEO}(sus)			–0.05		–	–	–	–	–	–	–60	–	–80	–	
			–0.2ª	0	–80	–	–60	–	–40	–	–	–	–	–	
V_{CER}(sus) R_{BE} = 100 Ω			–0.2ª		–80	–	–60	–	–40	–	–	–	–	–	V
V_{CEV}(sus		1.5	–0.2ª		–80	–	–60	–	–40	–	–	–	–	–	
h_{FE}	–3		–0.75ª		–	–	–	–	–	–	500	–	500	–	
	–3		–3ª		–	–	–	–	1000	20,000	1000	–	1000	–	
	–3		–5ª		1000	20,000	1000	20,000	–	–	–	–	–	–	
	–3		–8ª		–	–	–	–	100	–	–	–	–	–	
	–3		–10ª		100	–	100	–	–	–	–	–	–	–	
V_{BE}	–3		–3ª		–	–	–	–	–	–2.8	–	–2.5	–	–2.5	
	–3		–5ª		–	–2.8	–	–2.8	–	–	–	–	–	–	V
	–3		–8ª		–	–	–	–	–	–4.5	–	–	–	–	
	–3		–10ª		–	–4.5	–	–4.5	–	–	–	–	–	–	
V_{CE}(sat)			–3ª	–0.006ª	–	–	–	–	–	–2	–	–	–	–	
			–3ª	–0.012ª	–	–	–	–	–	–	–	–2	–	–2	
			–5ª	–0.01ª	–	–2	–	–2	–	–	–	–	–	–	
			–5ª	–0.02ª	–	–	–	–	–	–	–	–4	–	–4	V
			–8ª	–0.08ª	–	–	–	–	–	–3	–	–	–	–	
			–10ª	–0.1ª	–	–3	–	–3	–	–	–	–	–	–	
V_F			8ª		–	–	–	–	–	4	–	–	–	–	V
			10ª		–	4	–	4	–	–	–	–	–	–	
h_{fe} f = 1 kHz	–5		–1		1000	–	1000	–	1000	–	1000	–	1000	–	
$\|h_{fe}\|$ f = 1 MHz	–5		–1		20	–	20	–	20	–	20	–	20	–	
$E_{s/b}$ L = 3 mH, R_{BE} = 100 Ω		1.5	–4.5		30	–	30	–	30	–	–	–	–	–	mJ
$I_{S/b}$ t = 1 s nonrep.	–20				–3.2	–	–3.2	–	–3.2	–	–3.2	–	–3.2	–	A
t_{ON} R_L = 20 Ω V_{CC} = –20 V			–3	I_{B1} = –0.012 I_{B2} = 0.012							1 (typ.)		1 (typ.)		µs
t_{OFF} R_L = 20 Ω V_{CC} = –20 V			–3	I_{B1} = –0.012 I_{B2} = 0.012							3 (typ.)		3 (typ.)		
$R_{\theta JC}$					–	1.92	–	1.92	–	1.92	–	1.92	–	1.92	°C/W

ª Pulsed: Pulse duration = 300 µs, duty factor ≤2%.

RCA8203, RCA8203A, RCA8203B, RCA125, RCA126

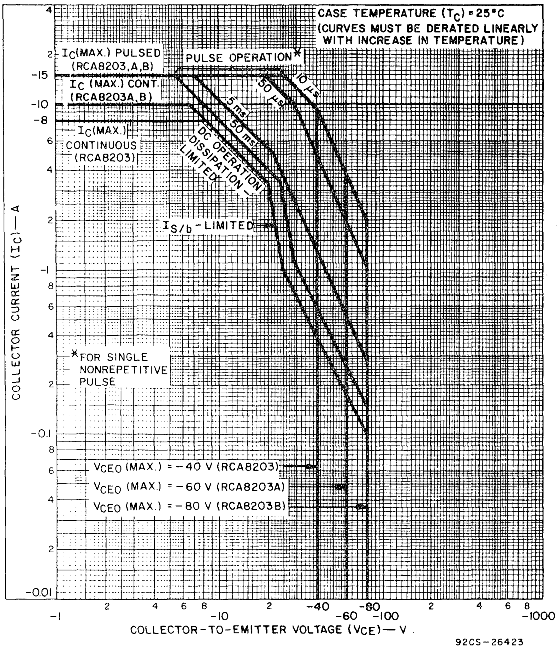


Fig. 4 - Maximum operating areas for RCA8203, RCA8203A, RCA8203B.

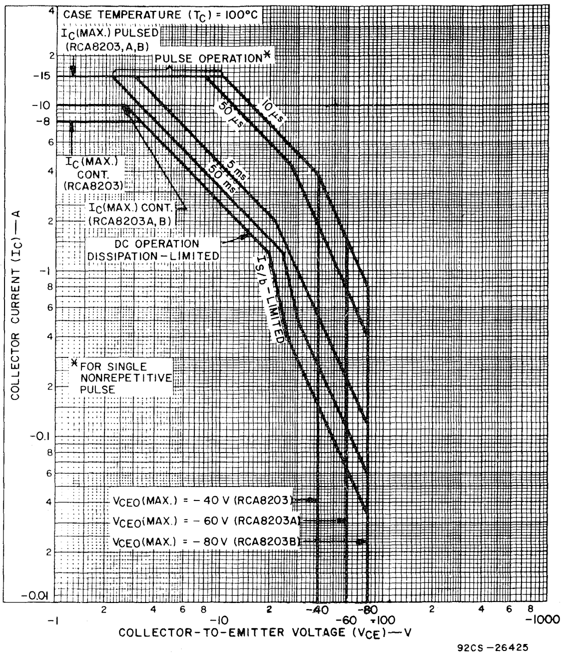


Fig. 5 - Maximum operating areas for RCA8203, RCA8203A, RCA8203B at $T_C = 100^oC$.

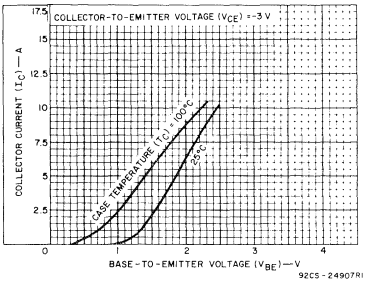


Fig. 7 - Typical transfer characteristics for RCA8203, RCA8203A, RCA8203B.

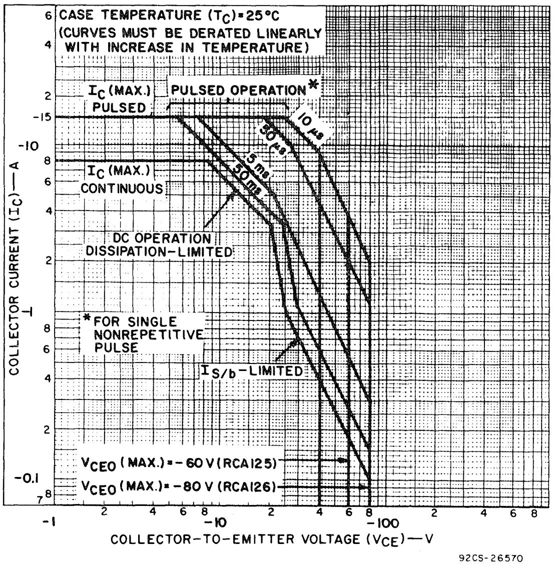


Fig. 6 - Maximum operating areas for RCA125, RCA126.

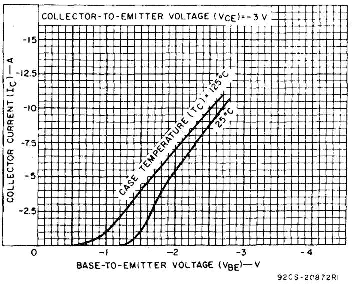


Fig. 8 - Typical transfer characteristics for RCA125, RCA126.

RCA8203, RCA8203A, RCA8203B, RCA125, RCA126

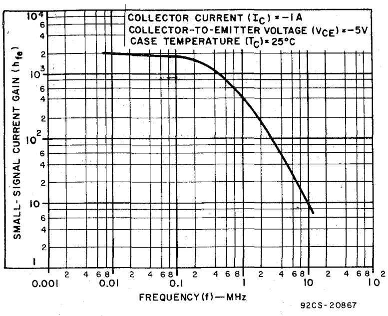


Fig. 9 - Typical small-signal gain for all types.

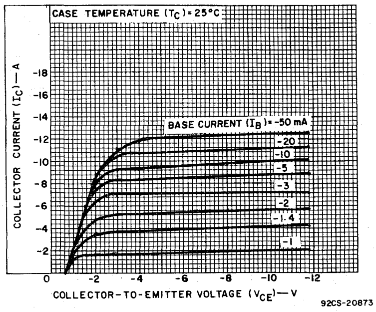


Fig. 10 - Typical output characteristics for all types.

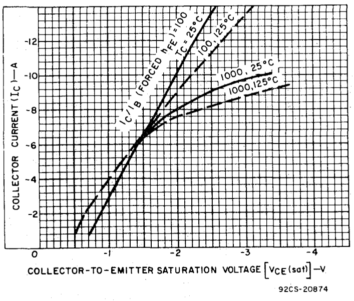


Fig. 11 - Typical saturation characteristics for RCA8203, RCA8203A, RCA8203B.

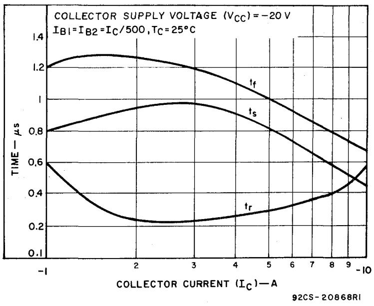


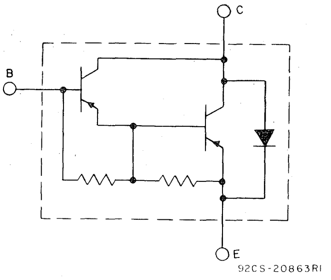
Fig. 12 - Typical saturated switching-time characteristics for all types.

RCA8350, RCA8350A, RCA8350B

10-Ampere P-N-P Darlington Power Transistors

40-60-80 Volts, 70 Watts
Gain of 1000 at 5 A

The RCA8350, RCA8350A and RCA8350B● are monolithic silicon p-n-p Darlington transistors designed for low- and medium-frequency power applications. The high gain of these devices makes it possible for them to be driven directly from integrated circuits. They are complementary to the 2N6383, 2N6384, and 2N6385.



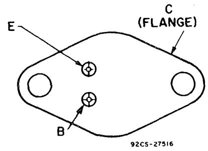
Features:

- Operates from IC without predriver
- High reverse second-breakdown capability

Applications:

- Power switching ■ Audio amplifiers
- Hammer drivers
- Series and shunt regulators

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	RCA8350B	RCA8350A	RCA8350	
V_{CBO}	−80	−60	−40	V
V_{CER}(sus)				
R_{BE} = 100 Ω	−80	−60	−40	V
V_{CEO}(sus)	−80	−60	−40	V
V_{CEV}(sus)				
V_{BE} = −1.5 V	−80	−60	−40	V
V_{EBO}	−5	−5	−5	V
I_C	−10	−10	−10	A
I_{CM}	−15	−15	−15	A
I_B	−0.25	−0.25	−0.25	A
P_T				
$T_C \leqslant 25^oC$	70	70	70	W
$T_C > 25^oC$	Derate linearly to 150 °C			
T_{stg}, T_J	−65 to +150			°C
T_L				
At distances ⩾ 1/32 in. (0.8 mm) from seating plane for 10 s max.	235			°C

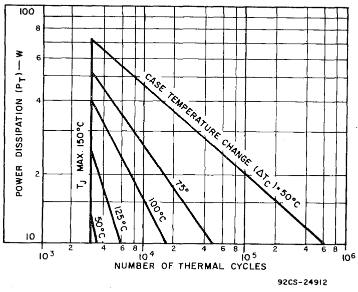


Fig. 2 - Thermal-cycling rating chart for all types.

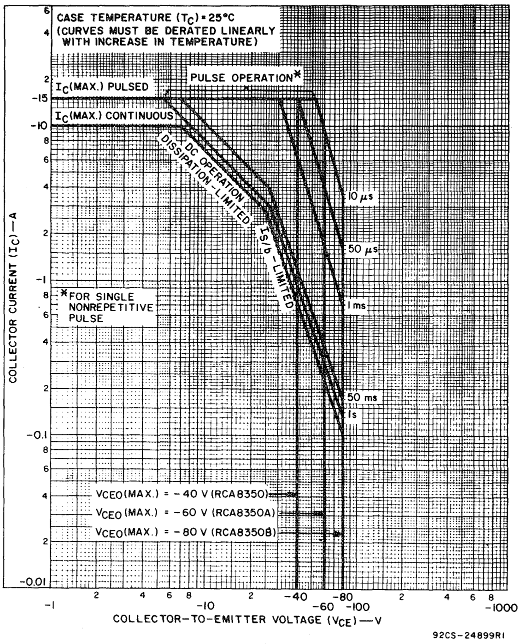


Fig. 3 - Maximum operating areas for all types.

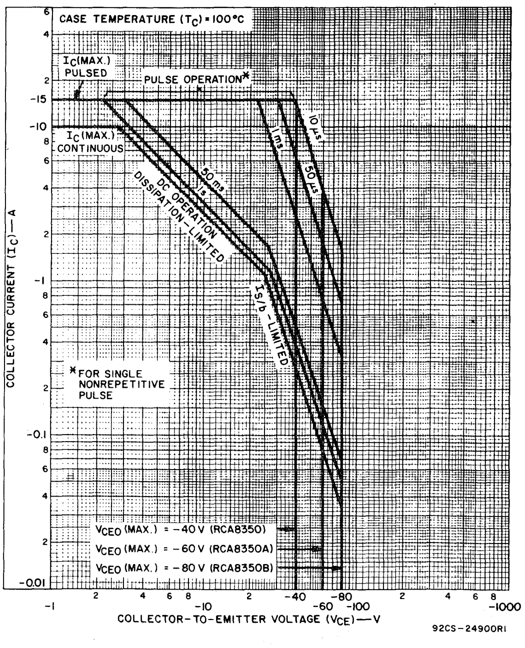


Fig. 4 - Maximum operating areas for all types at $T_C = 100^oC$.

● Formerly RCA Dev. Nos. TA8351, TA8488, and TA8350, respectively.

RCA8350, RCA8350A, RCA8350B

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC SYMBOL	TEST CONDITIONS				LIMITS						UNITS
	VOLTAGE V dc		CURRENT A dc		RCA8350B		RCA8350A		RCA8350		
	V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
I_{CEO}	–80			0	–	–1	–	–	–	–	mA
	–60			0	–	–	–	–1	–	–	
	–40			0	–	–	–	–	–	–1	
I_{CEV}	–80	1.5			–	–0.3	–	–	–	–	
	–60	1.5			–	–	–	–0.3	–	–	
	–40	1.5			–	–	–	–	–	–0.3	
T_C = 150°C	–80	1.5			–	–3	–	–	–	–	
	–60	1.5			–	–	–	–3	–	–	
	–40	1.5			–	–	–	–	–	–3	
I_{EBO}		5	0		–	–10	–	–10	–	–10	mA
$V_{CEO}(sus)$			–0.2ª	0	–80	–	–60	–	–40	–	V
$V_{CER}(sus)$ R_{BE} = 100 Ω			–0.2ª		–80	–	–60	–	–40	–	
$V_{CEV}(sus)$		1.5	–0.2ª		–80	–	–60	–	–40	–	
h_{FE}	–3		–5ª		1000	20,000	1000	20,000	1000	20,000	
	–3		–10ª		100	–	100	–	100	–	
V_{BE}	–3		–5ª		–	–2.8	–	–2.8	–	–2.8	
	–3		–10ª		–	–4.5	–	–4.5	–	–4.5	V
$V_{CE}(sat)$			–5ª	–0.01ª	–	–2	–	–2	–	–2	
			–10ª	–0.1ª	–	–3	–	–3	–	–3	V
V_F			10ª		–	4	–	4	–	4	V
h_{fe} f = 1 kHz	–5		–1		1000	–	1000	–	1000	–	
$\|h_{fe}\|$ f = 1 MHz	–5		–1		20	–	20	–	20	–	
$E_{S/b}$ L = 3 mH, R_{BE} = 100 Ω		1.5	–4.5		30	–	30	–	30	–	mJ
$I_{S/b}$ t = 1 s, nonrep.	–35				–1	–	–1	–	–1	–	
	–25				–2.8	–	–2.8	–	–2.8	–	A
$R_{\theta JC}$					–	1.75	–	1.75	–	1.75	°C/W

ª Pulsed: Pulse duration = 300 μs, duty factor = 1.8%.

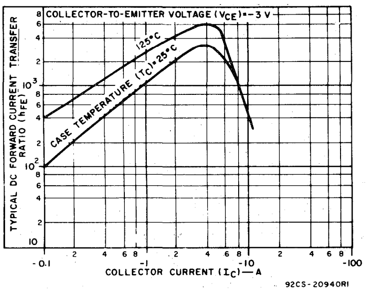


Fig. 5 - Typical dc beta characteristics for all types.

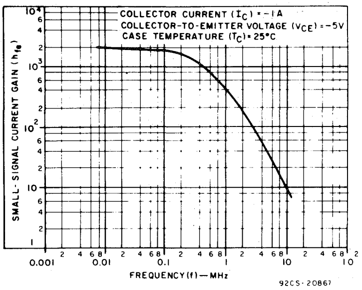


Fig. 6 - Typical small-signal gain for all types.

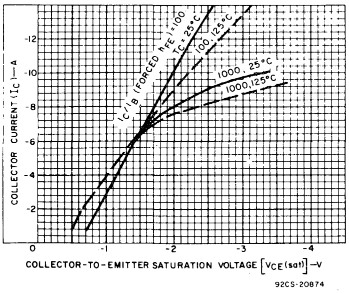


Fig. 7 - Typical saturation characteristics for all types.

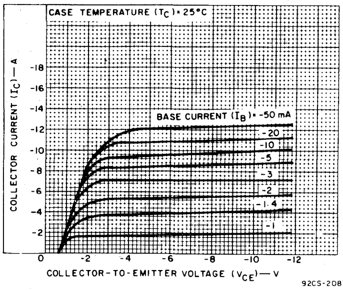


Fig. 8 - Typical output characteristics for all types.

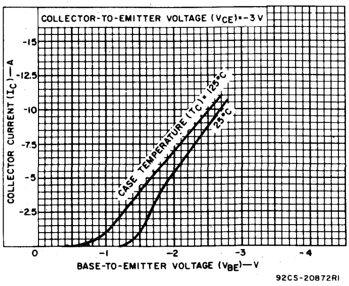


Fig. 9 - Typical transfer characteristics for all types.

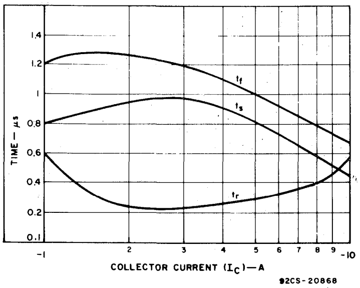


Fig. 10 - Typical saturated switching-time characteristics for all types.

RCA8766 Series

10-Ampere N-P-N Monolithic Darlington Power Transistors

350, 400, 450 Volts, 150 Watts
Gain of 100 at 4, 6A

The RCA-8766 Series● are monolithic n-p-n silicon Darlington transistors designed for automotive electronic power applications. The pi-nu construction of these devices provides good forward and reverse second-breakdown capability; their high gain makes it possible for them to be driven directly from integrated circuits.

The devices in the series differ primarily in voltage ratings and in the current at which the dc gain is specified.

The RCA-8766 Series are supplied in the JEDEC TO-3 hermetic steel package.

● Formerly RCA Dev. Nos. TA8766 Series.

Features:

- **Operates from IC without predriver**
- **Low leakage at high temperature**
- **High reverse second-breakdown capability**

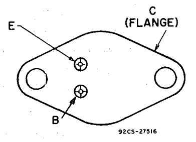
Applications:

- **Power switching**
- **Solenoid drivers**
- **Automotive Ignition**
- **Series and shunt regulators**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	RCA8766 RCA8766A	RCA8766B RCA8766C	RCA8766D RCA8766E	
V_{CBO}	350	400	450	V
$V_{CER}(sus)$				
$R_{BE} = 50\ \Omega$	350	400	450	V
$V_{CEO}(sus)$	350	400	450	V
V_{EBO}	5	5	5	V
I_C	10	10	10	A
I_{CM}	15	15	15	A
I_B	1	1	1	A
P_T				
$T_C \leqslant 25°C$	150	150	150	W
$T_C > 25°C$		1		°C/W
T_{stg}, T_J		−65 to +175		°C
T_L				
At distances ⩾ 1/8 in. (3.17 mm) from case for 10 s max.		235		°C

TERMINAL DESIGNATIONS



JEDEC TO-3

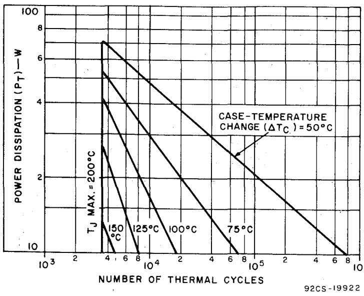


Fig. 1 — Thermal-cycling rating chart for all types.

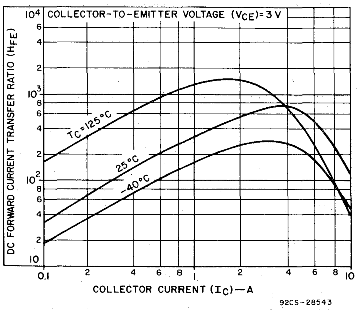


Fig. 2 — Typical DC beta characteristics for all types.

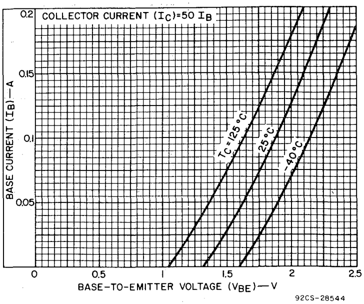


Fig. 3 — Typical input characteristics for all types.

ELECTRICAL CHARACTERISTICS, *at Case Temperature (T_C) 25°C unless otherwise specified*

CHARACTERISTIC	TEST CONDITIONS			LIMITS						UNITS
	VOLTAGE V dc	CURRENT A dc		RCA8766 RCA8766A		RCA8766B RCA8766C		RCA8766D RCA8766E		
	V_{CE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
I_{CER} R_{BE} = 50 Ω	350			–	1	–	–	–	–	mA
	400			–	–	–	1	–	–	
	450			–	–	–	–	–	1	
T_C = 150°C	350			–	10	–	–	–	–	
	400			–	–	–	10	–	–	
	450			–	–	–	–	–	10	
I_{EBO} V_{BE} = −5 V		0		–	60	–	60	–	60	mA
V_{CEO}(sus)		0.2[a]	0	350	–	400	–	450	–	V
h_{FE} RCA8766	3	6[a]		100	–	–	–	–	–	
RCA8766A	3	4[a]		100	–	–	–	–	–	
RCA8766B	3	6[a]		–	–	100	–	–	–	
RCA8766C	3	4[a]		–	–	100	–	–	–	
RCA8766D	3	6[a]		–	–	–	–	100	–	
RCA8766E	3	4[a]		–	–	–	–	100	–	
V_{BE} RCA8766	3	6[a]		–	2.5	–	–	–	–	V
RCA8766A	3	4[a]		–	2.5	–	–	–	–	
RCA8766B	3	6[a]		–	–	–	2.5	–	–	
RCA8766C	3	4[a]		–	–	–	2.5	–	–	
RCA8766D	3	6[a]		–	–	–	–	–	2.5	
RCA8766E	3	4[a]		–	–	–	–	–	2.5	
V_{CE}(sat) RCA8766		6[a]	0.2[a]	–	1.5	–	–	–		V
RCA8766A		4[a]	0.133[a]	–	1.5	–	–	–		
RCA8766B		6[a]	0.2[a]	–	–	–	1.5	–		
RCA8766C		4[a]	0.133[a]	–	–	–	1.5	–	–	
RCA8766D		6[a]	0.2[a]	–	–	–	–	–	1.5	
RCA8766E		4[a]	0.133[a]	–	–	–	–	–	1.5	
All Types		8[a]	0.5[a]	–	2.5	–	2.5	–	2.5	
V_F		7[a]		–	2	–	2	–	2	V
$\|h_{fe}\|$ f = 1 MHz	5	1		10	–	10	–	10	–	
$I_{S/b}$ t = 1 s, nonrep.	30			5	–	5	–	5	–	A
$R_{\theta JC}$				–	1	–	1	–	1	°C/W

[a] Pulsed: Pulse duration = 300 μs, duty factor = 1.8%.

RCA8766 Series

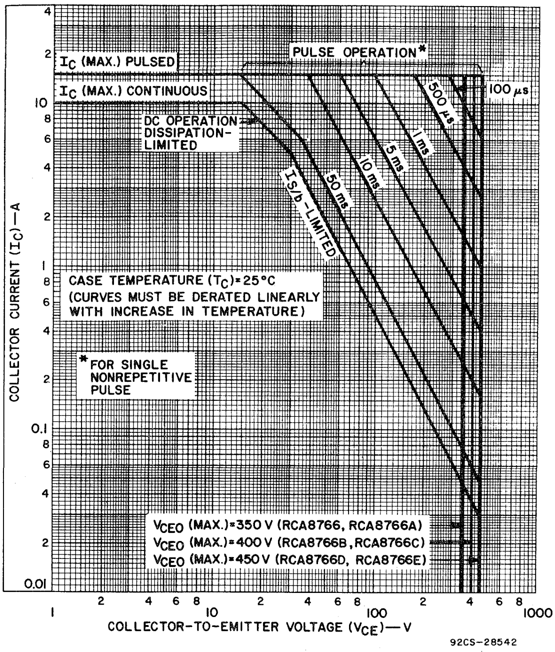


Fig. 4 — Maximum operating areas for all types.

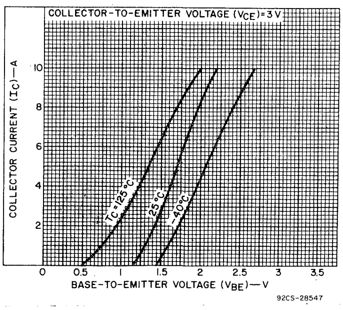


Fig. 5 — Typical transfer characteristics for all types.

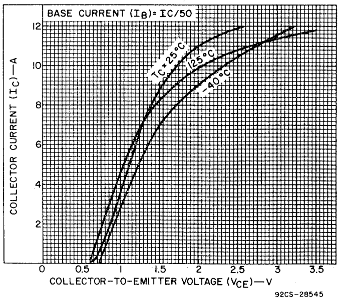


Fig. 6 — Typical output characteristics for all types.

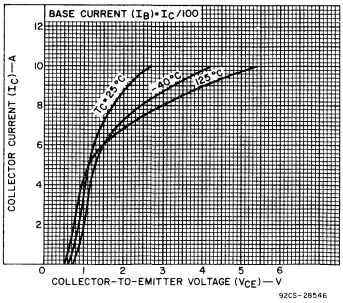


Fig. 7 — Typical output characteristics for all types.

RCA8767, RCA8767A, RCA8767B, RCA8767C

Preliminary Data

High-Voltage, High-Current Silicon N-P-N Power-Switching Transistors

For Off-Line Power Supplies and
Other High-Voltage Switching Applications

Features:

- **Fast Switching Speed**
- **High Voltage Ratings:** **V_{CEX}=350 V to 450 V**
- **Low V_{CE}(sat) at I_C=6 A**

Applications:

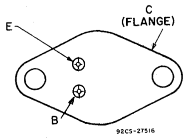
- **Off-Line Power Supplies**
- **High Voltage Inverters**
- **Switching Regulators**
- **Motor Controls**

The RCA8767 series of silicon n-p-n power transistors feature high-voltage capability, fast switching speeds, and low saturation voltages, together with high safe-operating-area (SOA) ratings for both forward- and reverse-bias conditions. They are specially designed for use in off-line switch mode power supplies and are also well suited for use in a wide range of inverter or converter circuits, pulse-width-modulated regulators, and motor controls.

These high-voltage, high-speed transistors are 100-per-cent tested for parameters that are essential to the design of industrial high-power switching circuits. Switching times, including inductive turn-off time, and saturation voltages are characterized at 125°C, as well as at 25°C, to provide information for worst-case design analyses.

The RCA8767-series transistors are supplied in steel JEDEC TO-3 hermetic packages.

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	RCA8767	RCA8767A	RCA8767B	
V_{CEV} V_{BE} = −1.5 V	400	450	500	V
V_{CEX} (Clamped) V_{BE} = −1.5 V	350	400	450	V
V_{CEO}	300	350	400	V
V_{EBO}	8	8	8	V
I_C	10	10	10	A
I_{CM}	15	15	15	A
I_B	4	4	4	A
P_T				
T_C up to 25°C	175	175	175	W
T_C above 25°C	Derate at 1			W/°C
T_{stg}, T_J	−65 to +200			°C
T_L At distance ⩾ 1/16 in. (1.58 mm) from seating plane for 10 s max.	235			°C

RCA8767, RCA8767A, RCA8767B, RCA8767C

ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	TEST CONDITIONS				LIMITS						Units
	VOLTAGE V dc		CURRENT A dc		RCA8767		RCA8767A		RCA8767B		
	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
T_C = 25°C											
I_{CEV}	400	−1.5			–	1	–	–	–	–	mA
	450	−1.5			–	–	–	1	–	–	
	500	−1.5			–	–	–	–	–	1	
I_{EBO}		−8	0		–	2	–	2	–	2	mA
V_{CEO}(sus)[b]			0.2[a]	0	300	–	350	–	400	–	V
h_{FE}	3		6[a]		8	–	8	–	8	–	
V_{BE}(sat)			6[a]	1.2	–	1.25	–	1.25	–	1.25	V
V_{CE}(sat)			6[a]	1.2	–	1	–	1.25	–	1.5	V
V_{CEX}[b] (Clamped $E_{S/b}$) L=80μH,R_{BB}=10Ω		−4	6	1.2	350	–	400	–	450	–	V
t_r[c]			6	1.2	–	0.4	–	0.4	–	0.4	μs
t_s[c]			6	1.2[d]	–	1.7	–	1.7	–	1.7	
t_f[c]			6	1.2[d]	–	0.3	–	0.3	–	0.3	
t_{VI} L=170μH,R_C=20Ω Collector clamped to V_{CC}=125 V			6	1.2	–	0.4	–	0.4	–	0.4	
T_C = 125°C											
I_{CEV}	400	−1.5			–	3	–	–	–	–	mA
	450	−1.5			–	–	–	3	–	–	
	500	−1.5			–	–	–	–	–	3	
V_{CE}(sat)			6[a]	1.2	–	2	–	2.5	–	3	V
t_r[c]			6	1.2[e]	–	0.8	–	0.8	–	0.8	μs
t_s[c]			6	1.2[d]	–	3	–	3	–	3	
t_f[c]			6	1.2[d]	–	0.6	–	0.6	–	0.6	
t_{VI} L=170μH,R_C=20Ω Collector clamped to V_{CC}=125 V			6	1.2	–	0.8	–	0.8	–	0.8	

$R_{\theta JC}$					–	1	–	1	–	1	°C/W

[a] Pulsed: pulse duration=300 μs, duty factor ⩽ 2%.

[b] CAUTION: The sustaining voltage V_{CEO}(sus) and V_{CEX}(sus) MUST NOT be measured on a curve tracer.

[c] V_{CC} = 125 V, t_p = 20 μs.

[d] $I_{B1} = -I_{B2}$

RCA9113, RCA9113A, RCA9113B , RCA9113C

High-Voltage, High-Current Silicon N-P-N Power-Switching Transistors

For Off-Line Power Supplies and Other High-Voltage Switching Applications

The RCA9113-series of silicon n-p-n power transistors feature high-voltage capability, fast switching speeds, and low saturation voltages, together with high safe-operating-area (SOA) ratings for both forward- and reverse-bias conditions. These types are specially designed for use in off-line switch-mode power supplies and are also well suited for use in a wide range of inverter or converter circuits, pulse-width-modulated regulators, and motor controls.

These high-voltage, high-speed transistors are 100-per-cent tested for parameters that are essential to the design of industrial high-power switching circuits. Switching times, including inductive turn-off time, and saturation voltages are characterized at 125°C, as well as at 25°C, to provide information for worst-case design analyses.

The RCA9113-series transistors are supplied in steel JEDEC TO-3 hermetic packages.

Features

- **Fast Switching Speed**
- **High Voltage Ratings:** V_{CEX} = 350 V to 450 V
- **Low V_{CE}(sat) at I_C = 10 A**

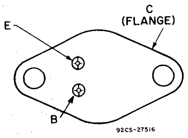
Applications

- **Off-Line Power Supplies**
- **High-Voltage Inverters**
- **Switching Regulators**
- **Motor Controls**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	RCA9113	RCA9113A	RCA9113B	
V_{CEV}				
V_{BE} = −1.5 V	400	450	500	V
V_{CEX} (Clamped)				
V_{BE} = −1.5 V	350	400	450	V
V_{CEO}	300	350	400	V
V_{EBO}	8	8	8	V
I_C	15	15	15	A
I_{CM}	22	22	22	A
I_B	6	6	6	A
P_T				
T_C up to 25°C	175	175	175	W
T_C above 25°C	Derate at 1 W/°C			
T_{stg}, T_J	−65 to +200			°C
T_L				
At distance ⩾1/16 in. (1.58 mm) from seating plane for 10 s max.	235			°C

TERMINAL DESIGNATIONS



JEDEC TO-3

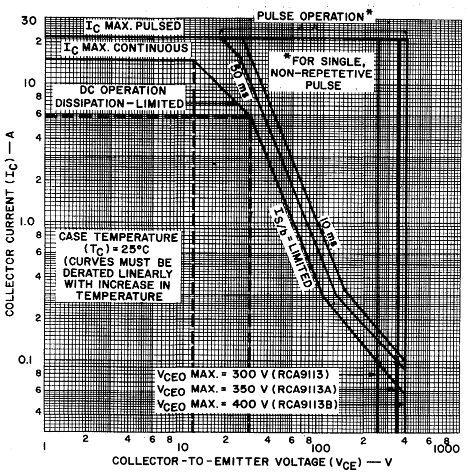


Fig. 1 — Maximum operating areas at T_C = 25°C for all types.

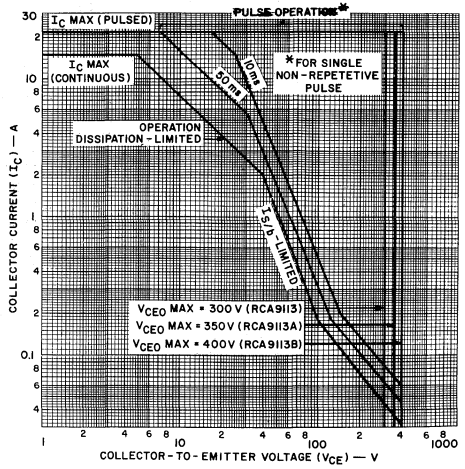


Fig. 2 — Maximum operating areas at T_C = 125°C for all types.

RCA9113, RCA9113A, RCA9113B , RCA9113C

ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	TEST CONDITIONS				LIMITS						UNITS
	Voltage V dc		Current A dc		RCA9113		RCA9113A		RCA9113B		
	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
$T_C = 25^oC$											
I_{CEV}	400	−1.5			–	2	–	–	–	–	mA
	450	−1.5			–	–	–	2	–	–	
	500	−1.5			–	–	–	–	–	2	
I_{EBO}		−8	0		–	2	–	2	–	2	
$V_{CEO}(sus)^b$			0.2^a	0	300	–	350	–	400	–	V
h_{FE}	3		5^a		15	–	15	–	15	–	
$V_{BE}(sat)$			10^a	2	–	2.25	–	2.25	–	2.25	V
$V_{CE}(sat)$			10^a	2	–	1	–	1.35	–	1.5	V
$V_{CEX}{}^b$ (Clamped $E_{S/b}$) L=50 μH, R_{BB}=50 Ω		−4	10	2	350	–	400	–	450	–	V
$t_d{}^c$			10	2^d	30 (Typ.)		30 (Typ.)		30 (Typ.)		ns
$t_r{}^c$			10	2^e	–	1	–	1	–	1	μs
$t_s{}^c$			10	2^d	–	1.8	–	1.8	–	1.8	
$t_f{}^c$			10	2^d	–	0.75	–	0.75	–	0.75	
$t_{vI}{}^e$ L=170 μH, R_C=20 Ω Collector Clamped to V_{CC}=240 V			10	2	–	0.9	–	0.9	–	0.9	
$T_C = 125^oC$											
I_{CEV}	400	−1.5			–	3	–	–	–	–	mA
	450	−1.5			–	–	–	3	–	–	
	500	−1.5			–	–	–	–	–	3	
$V_{CE}(sat)$			10^a	2	–	1.75	–	2.3	–	2.5	V
$t_r{}^c$			10	2^e	–	2	–	2	–	2	μs
$t_s{}^c$			10	2^d	–	3.2	–	3.2	–	3.2	
$t_f{}^c$			10	2^d	–	1.5	–	1.5	–	1.5	
$t_{vI}{}^e$ L=170 μH, R_C=20 Ω Collector Clamped to V_{CC}=240 V			10	2	–	1.8	–	1.8	–	1.8	
$R_{\theta JC}$					–	1	–	1	–	1	°C/W

[a] Pulsed; pulse duration=300 μs, duty factor ⩽ 2%.

[b] CAUTION: The sustaining voltages $V_{CEO}(sus)$ and $V_{CEX}(sus)$ MUST NOT be measured on a curve tracer.

[c] V_{CC} = 200 V, t_p = 20 μs

[d] $I_{B1} = -I_{B2}$

[e] t_p = 20 μs

RCA9113, RCA9113A, RCA9113B ,RCA9113C

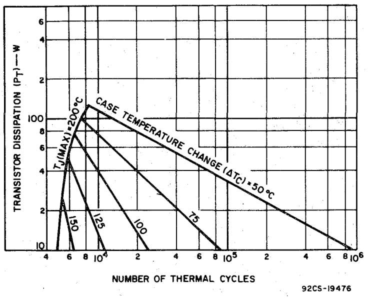


Fig. 3 — Thermal-cycling rating chart for all types.

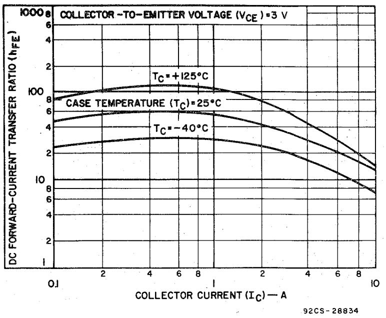


Fig. 4 — Typical dc beta characteristics for all types.

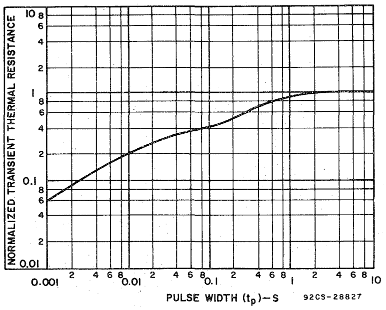


Fig. 5 — Typical thermal-response characteristic for all types.

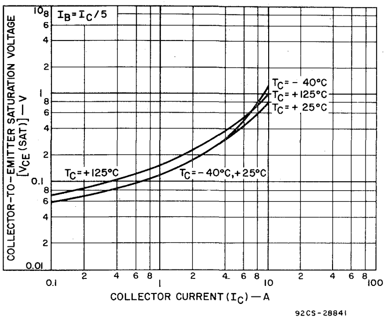


Fig. 6 — Typical collector-to-emitter saturation-voltage characteristics for all types.

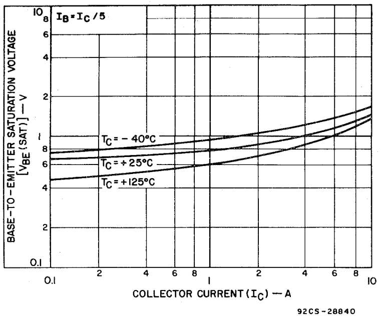


Fig. 7 — Typical base-to-emitter saturation-voltage characteristics for all types.

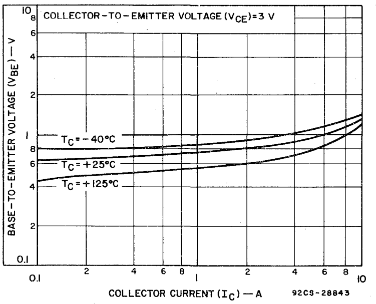


Fig. 8 — Typical base-to-emitter voltage as a function of collector current for all types.

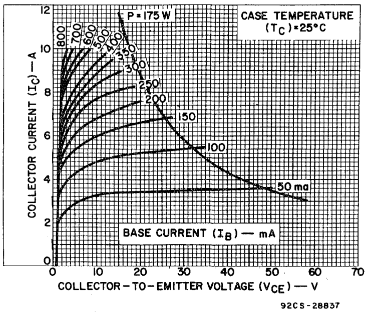


Fig. 9 — Typical output characteristics for all types.

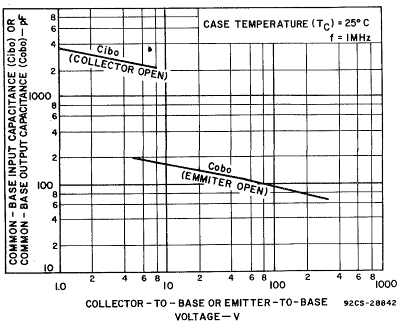


Fig. 10 — Typical common-base capacitance characteristics for all types.

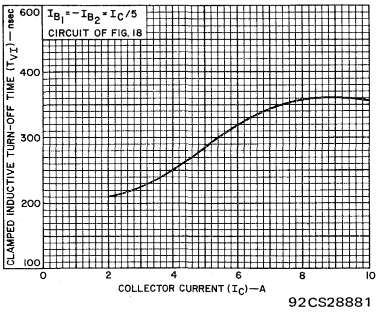


Fig. 11 — Typical clamped inductive fall-time characteristics for all types.

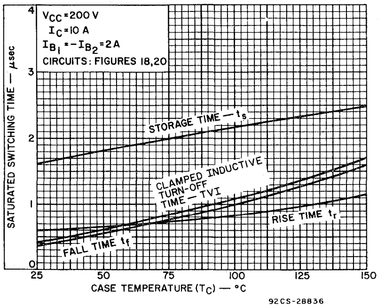


Fig. 12 — Typical saturated switching characteristics for all types.

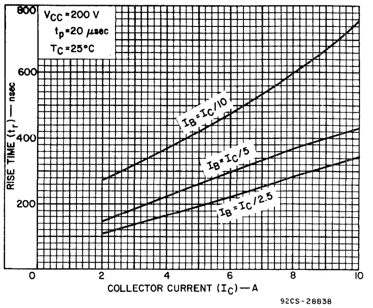


Fig. 13 — Typical rise-time characteristics for all types.

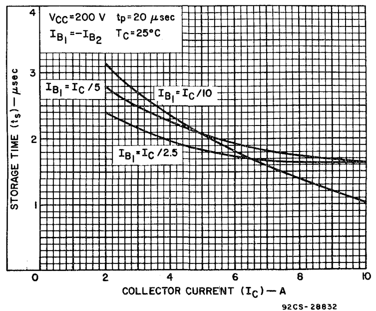


Fig. 14 — Typical storage-time characteristics for all types.

RCA9113, RCA9113A, RCA9113B , RCA9113C

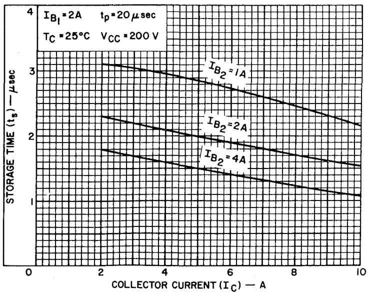


Fig. 15 — Typical storage-time characteristics for all types.

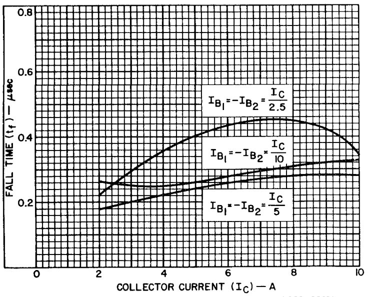


Fig. 16 — Typical fall-time characteristics for all types.

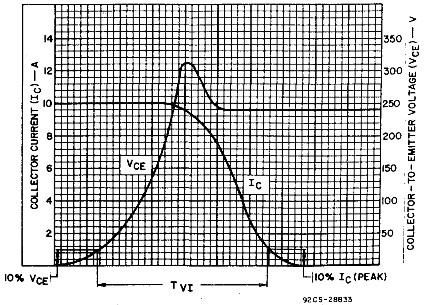


Fig. 17 — Oscilloscope display for measurement of inductive switching.

RCP111, RCP113, RCP115, RCP117 Series

High-Voltage, Medium-Power Silicon N-P-N Power Transistors

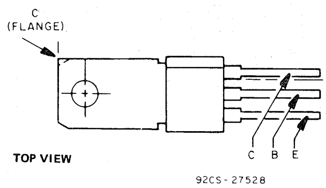
For TV Video Output and Linear-Amplifier Applications

The RCP111-, RCP113, RCP115-, and RCP117-series power transistors are double-diffused, epitaxial-collector silicon n-p-n transistors with planar junctions and field-shield construction. These transistors are designed especially for TV applications such as RGB output, chroma output, and video output. They are also suitable for use in regulators, audio output and amplifier circuits, and electrostatic deflection in display circuits. The devices are supplied in the JEDEC TO-202AB VERSATAB molded plastic package.

Features:

- Thermal-cycling ratings
- Maximum safe-area-of-operation curves
- High gain-bandwidth product: f_T = 80 MHz typ.

TERMINAL DESIGNATIONS



JEDEC TO-202AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		RCP111D RCP113D	RCP111C RCP113C	RCP111B RCP113B	RCP111A RCP113A	RCP115B RCP117B	RCP115 RCP117	
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:								
With base open	$V_{CEO}(sus)$	350	300	250	200	250	100	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	7	7	7	5	5	V
CONTINUOUS COLLECTOR CURRENT	I_C	150	150	150	150	150	150	mA
CONTINUOUS BASE CURRENT	I_B	50	50	50	50	50	50	mA
TRANSISTOR DISSIPATION:	P_T							
At case temperatures up to 25°C		6.25	6.25	6.25	6.25	6.25	6.25	W
At ambient temperatures up to 25°C		1.56	1.56	1.56	1.56	1.56	1.56	W
For pulse operation		See Fig. 7						
TEMPERATURE RANGE:								
Storage & Operating (Junction)		−65 to 150						°C
LEAD TEMPERATURE (During Soldering):								
At distances ≥ 1/16 in. (1.39 mm) from case for 10 s max.		230						°C

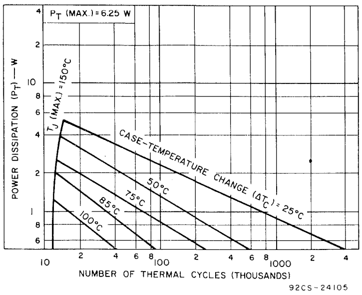


Fig. 1 — Thermal-cycling rating chart for all types.

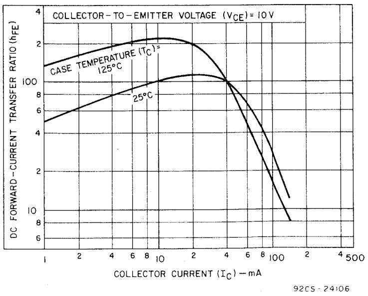


Fig. 2 — Typical dc beta characteristics for all types.

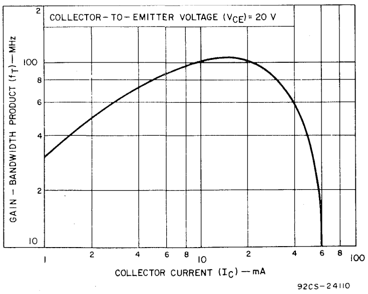


Fig. 3 — Typical gain-bandwidth product for all types.

RCP111, RCP113, RCP115, RCP117 Series

ELECTRICAL CHARACTERISTICS, *At Case Temperature, T_C = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS					LIMITS								UNITS
	VOLTAGE V dc			CURRENT mA dc		RCP111A RCP113A		RCP111B RCP113B		RCP111C RCP113C		RCP111D RCP113D		
	V_{CB}	V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
I_{CBO}	350					–	–	–	–	–	–	–	1	µA
	300					–	–	–	–	–	1	–	–	
	250					–	–	–	1	–	–	–	–	
	200					–	1	–	–	–	–	–	–	
I_{CEO}		250			0	–	–	–	–	–	–	–	5	µA
		200			0	–	–	–	–	–	5	–	–	
		175			0	–	–	–	5	–	–	–	–	
		150			0	–	5	–	–	–	–	–	–	
I_{EBO}			6	0		–	10	–	10	–	10	–	10	µA
h_{FE} RCP111 Series		10		25[a]		50	300	50	300	50	300	50	300	
		10		1[a]		25	–	25	–	25	–	25	–	
RCP113 Series		10		25[a]		30	150	30	150	30	150	30	150	
		10		1[a]		15	–	15	–	15	–	15	–	
$V_{CEO}(sus)$[b]				20[a]	0	200	–	250	–	300	–	350	–	V
V_{BE}		10		25[a]		–	0.8	–	0.8	–	0.8	–	0.8	V
$V_{(BR)EBO}$ (I_E = 1 mA)				0		7	–	7	–	7	–	7	–	V
$V_{CE}(sat)$				25[a]	2.5	–	1	–	1	–	1	–	1	V
$\|h_{fe}\|$ (f = 20 MHz)		20		15		4 (typ.)		(4 typ.)		4 (typ.)		4 (typ.)		
f_T		20		15		80 (typ.)		80 (typ.)		80 (typ.)		80 (typ.)		MHz
$I_{S/b}$ (t = 0.05 s)		100				100	–	100	–	100	–	100	–	mA
C_{cb} (I_E = 0)	20			25		–	2.25	–	2.25	–	2.25	–	2.25	pF
$R_{\theta JC}$						–	20	–	20	–	20	–	20	°C/W
$R_{\theta JA}$						–	80	–	80	–	80	–	80	

[a] Pulsed, pulse duration = 300 µs, duty factor ⩽2%.

[b] CAUTION: Sustaining voltage, $V_{CEO}(sus)$, MUST NOT be measured on a curve tracer.

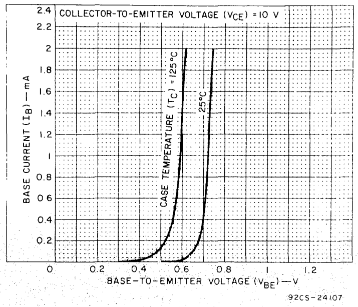


Fig. 4 – Typical input characteristics for all types.

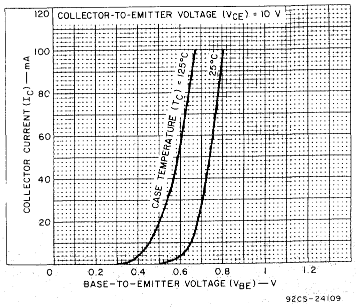


Fig. 5 – Typical transfer characteristics for all types.

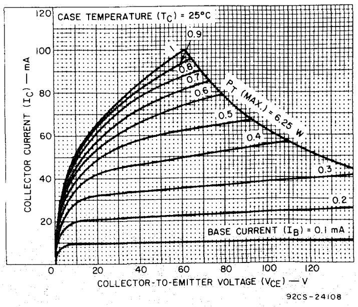


Fig. 6 – Typical output characteristics for all types.

RCP111, RCP113, RCP115, RCP117 Series

ELECTRICAL CHARACTERISTICS, *At Case Temperature, T_C = 25°C Unless Otherwise Specified*

CHARACTERISTIC	TEST CONDITIONS VOLTAGE V dc V_{CB}	V_{CE}	V_{BE}	CURRENT mA dc I_C	I_B	LIMITS RCP115A MIN.	MAX.	RCP115B MIN.	MAX.	RCP117A MIN.	MAX.	RCP117B MIN.	MAX.	UNITS
I_{CBO}	250					–	–	–	50	–	–	–	50	µA
	100					–	50	–	–	–	50	–	–	
I_{CEO}		175			0	–	–	–	100	–	–	–	100	µA
		70			0	–	100	–	–	–	100	–	–	
h_{FE}		10		25[a]		50	–	50	–	20	–	20	–	
		10		1[a]		10	–	10	–	10	–	10	–	
$V_{CEO}(sus)$[b]				20[a]	0	100	–	250	–	100	–	250	–	V
V_{BE}		10		25[a]		–	1.5	–	1.5	–	1.5	–	1.5	V
$V_{(BR)EBO}$ (I_E = 1 mA)				0		5	–	5	–	5	–	5	–	V
$V_{CE}(sat)$				25[a]	5	–	2	–	2	–	2	–	2	V
$\lvert h_{fe} \rvert$ (f = 20 MHz)		20		15		4 (typ.)		4 (typ.)		4 (typ.)		4 (typ.)		
f_T		20		15		80 (typ.)		80 (typ.)		80 (typ.)		80 (typ.)		MHz
$I_{S/b}$ (t = 0.05 s)		75				130	–	130	–	130	–	130	–	mA
C_{cb} (I_E = 0)		20		25		–	2.25	–	2.25	–	2.25	–	2.25	pF
$R_{\theta JC}$						–	20	–	20	–	20	–	20	°C/W
$R_{\theta JA}$						–	80	–	80	–	80	–	80	

[a] Pulsed, pulse duration = 300 µs, duty factor ≤2%.

[b] CAUTION: Sustaining voltage, $V_{CEO}(sus)$, MUST NOT be measured on a curve tracer.

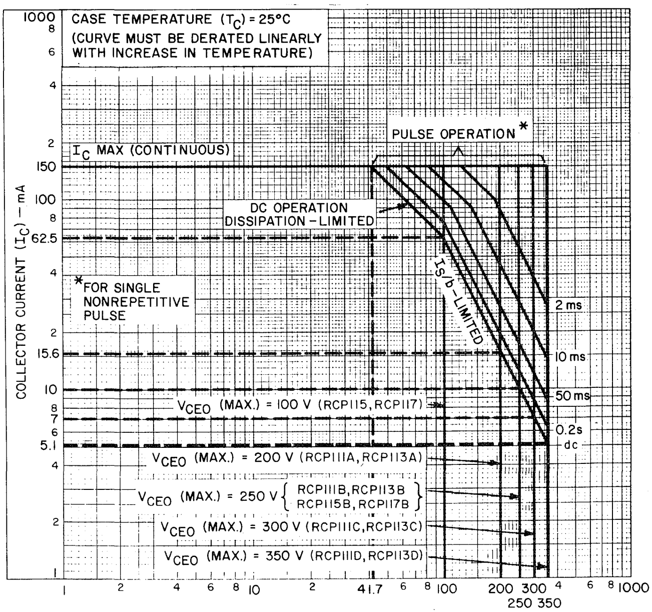


Fig. 7 — Maximum operating areas for all types.

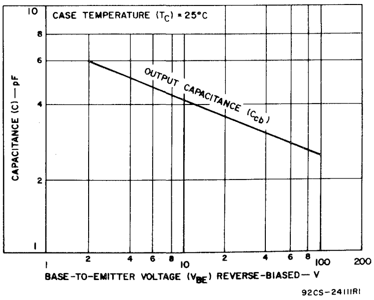


Fig. 8 — Typical junction capacitance vs. reverse-bias base-to-emitter voltage.

RCP131, RCP133, RCP135, RCP137 Series
High-Voltage, Medium-Power Silicon N-P-N Power Transistors

For TV Video Output, Horizontal Driver, and Linear-Amplifier Applications

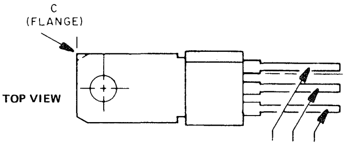
The RCP131-, RCP133-, RCP135-, and RCP137-series devices are double-diffused, epitaxial-collector silicon n-p-n power transistors with planar junctions and field-shield construction. These transistors are designed especially for TV applications such as horizontal driver, chroma output, and video output. They are also suitable for use in regulators, audio output and amplifier circuits, and electrostatic deflection in display circuits. The devices are supplied in the VERSATAB JEDEC TO-202AB, plastic package.

Features:
- Thermal-cycling ratings
- Maximum safe-area-of-operation curves
- High gain-bandwidth product: f_T = 30 MHz min.

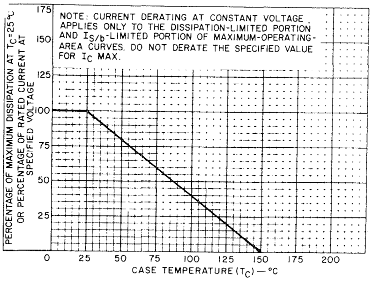
MAXIMUM RATINGS, *Absolute-Maximum Values:*

	RCP131A RCP133A	RCP131B RCP133B	RCP131C RCP133C	RCP131D RCP133D	RCP135 RCP137	RCP135B RCP137B	
V_{CEO}(sus)	200	250	300	350	100	250	V
V_{EBO}	7	7	7	7	5	5	V
I_C	1	1	1	1	1	1	A
I_B	0.5	0.5	0.5	0.5	0.5	0.5	A
P_T:							
$T_C \leqslant 25°C$	10	10	10	10	10	10	W
$T_A \leqslant 25°C$	1.75	1.75	1.75	1.75	1.75	1.75	W
For pulse operation	See Fig. 1						
T_{stg}, T_J	−65 to 150						°C
T_L: During soldering at distance $\geqslant$ 1/16 in. (1.39 mm) from case for 10 s max.	230						°C

TERMINAL DESIGNATIONS

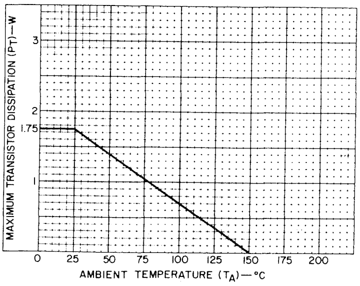


92CS-27528 **JEDEC TO-202AB**



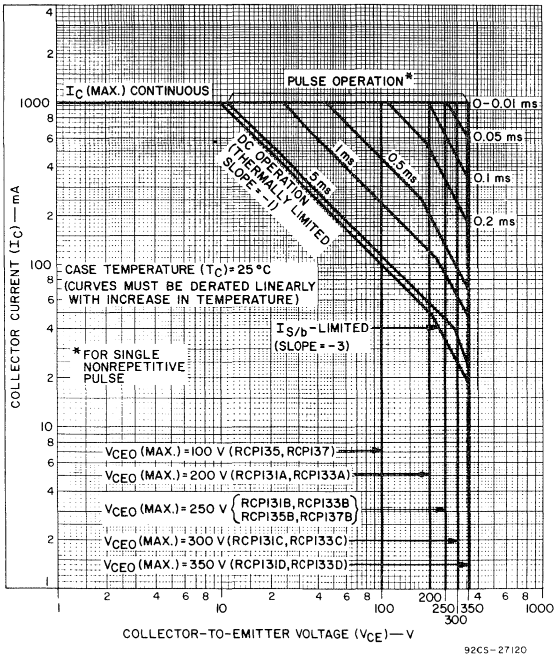
92CS-24103

Fig. 2—Dissipation derating curve at case temperature for all types.



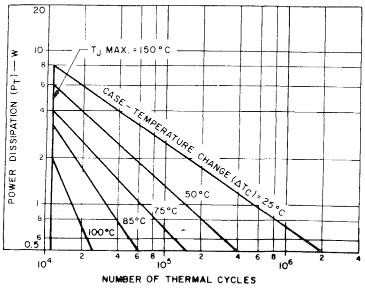
92CS-27121

Fig. 3—Dissipation derating curve at ambient temperature for all types.



92CS-27120

Fig. 1—Maximum operating areas for all types.



92CS-24109R1

Fig. 4—Thermal-cycling rating chart for all types.

RCP131, RCP133, RCP135, RCP137 Series

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C*

CHARACTERISTIC	TEST CONDITIONS					LIMITS				UNITS
	VOLTAGE V dc			CURRENT mA dc		RCP131A RCP133A RCP131C RCP133C RCP135 RCP137		RCP131B RCP133B RCP131D RCP133D RCP135B RCP137B		
	V_{CB}	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
I_{CBO} (I_E = 0)										µA
RCP131A, RCP133A	200					–	5	–	–	
RCP131B, RCP133B	250					–	–	–	5	
RCP131C, RCP133C	300					–	5	–	–	
RCP131D, RCP133D	350					–	–	–	5	
RCP135, RCP137	100					–	50	–	–	
RCP135B, RCP137B	250					–	–	–	50	
I_{CEO}										µA
RCP131A, RCP133A		150			0	–	10	–	–	
RCP131B, RCP133B		175			0	–	–	–	10	
RCP131C, RCP133C		200			0	–	10	–	–	
RCP131D, RCP133D		250			0	–	–	–	10	
RCP135, RCP137		50			0	–	100	–	–	
RCP135B, RCP137B		125			0	–	–	–	100	
I_{EBO} (RCP131, RCP133-series only)			−6	0		–	10	–	10	µA
h_{FE}										
RCP131-series		10		50^a		50	300	50	300	
RCP133-series		10		50^a		30	150	30	150	
RCP135-series		10		50^a		50	–	50	–	
RCP137-series		10		50^a		20	–	20	–	
V_{CEO}(sus)										V
RCP131A, RCP133A				20^a	0	200^b	–	–	–	
RCP131B, RCP133B				20^a	0	–	–	250^b	–	
RCP131C, RCP133C				20^a	0	300^b	–	–	–	
RCP131D, RCP133D				20^a	0	–	–	350^b	–	
RCP135, RCP137				20^a	0	100^b	–	–	–	
RCP135B, RCP137B				20^a	0	–	–	250^b	–	
V_{BE}										V
RCP131, RCP133-series		10		50^a		–	1	–	1	
RCP135, RCP137-series		10		50^a		–	1.5	–	1.5	
$V_{(BR)EBO}$ (I_E = 1 mA)										V
RCP131, RCP133-series				0		7	–	7	–	
RCP135, RCP137-series				0		5	–	5	–	
V_{CE}(sat)										V
RCP131, RCP133-series				50^a		–	1	–	1	
RCP135, RCP137-series				50^a	5	–	5	–	5	
$\|h_{fe}\|$ (f = 3 MHz)		20		20		10	–	10	–	
f_T		20		20		30	–	30	–	MHz
$I_{S/b}$ (t = 0.4 s)		100				100	–	100	–	mA
C_{ob} (f = 1 MHz)		20				–	8	–	8	pF
$R_{\theta JC}$						–	12.5	–	12.5	°C/W
$R_{\theta JA}$						–	71.4	–	71.4	

[a] Pulsed, pulse duration = 300 µs, duty factor ⩽ 2%.

[b] CAUTION: Sustaining voltage, V_{CEO}(sus), MUST NOT be measured on a curve tracer.

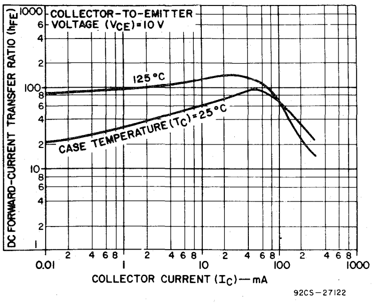


Fig. 5 - Typical dc beta characteristics for all types.

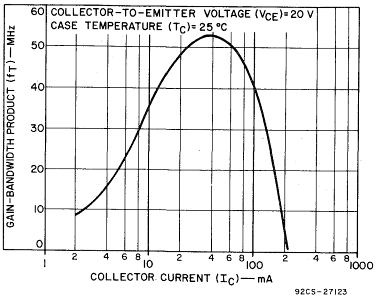


Fig. 6 - Typical gain-bandwidth product for all types.

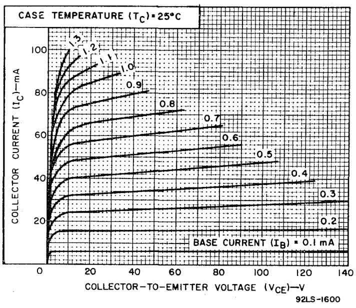


Fig. 7 - Typical output characteristics for all types.

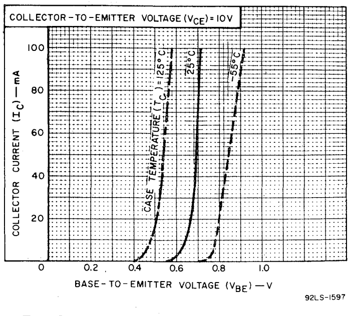


Fig. 8 - Typical transfer characteristics for all types.

RCP700, RCP702, RCP704, RCP706 Series
RCP701, RCP703, RCP705, RCP707 Series

General-Purpose, Medium- Power Silicon N-P-N and P-N-P Planar Transistors

The RCA-RCP700-, RCP702-, RCP704-, and RCP706-series power transistors are double-diffused, epitaxial-planar silicon p-n-p transistors. The RCA-RCP701-, RCP703-, RCP 705-, and RCP707-series power transistors are double-diffused, epitaxial-planar silicon n-p-n transistors.

All of these devices are intended for a wide variety of large-signal, general-purpose applications such as complementary vertical deflection, TV sound output, regulators, and driver and output stages of audio amplifiers.

The RCP700-, RCP702-, RCP704-, and RCP706-series types are p-n-p complements of the n-p-n devices in the RCP701, RCP703, RCP705, and RCP707 series.

These are supplied in the JEDEC TO-202AB molded plastic package.

Features

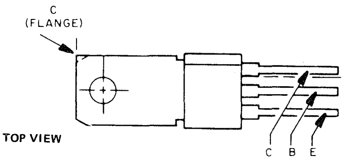
- **Maximum safe-area-of-operation curves specified for dc operation**
- **Planar construction for low noise and low leakage**
- **High gain at high current**
- **Fast switching time**
- **Thermal-cycling ratings**
- **Types in RCP700, RCP702, RCP704, and RCP706 series are p-n-p complements of n-p-n types in RCP701, RCP703, RCP705, and RCP707 series**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	RCP700D RCP702D RCP701D RCP703D	RCP700C RCP702C RCP701C RCP703C	RCP700B RCP702B RCP701B RCP703B	RCP700A RCP702A RCP701A RCP703A	RCP704B RCP706B RCP705B RCP707B	RCP704◆ RCP706◆ RCP705 RCP707	
V_{CBO}	125	105	85	55	85	45	V
$V_{CEO}(sus)$	100	80	60	40	60	30	V
V_{EBO}	5						V
I_C	2						A
I_B	1						A
P_T:							
$T_C \leqslant 25^oC$	10						W
$T_C > 25^oC$	Derate linearly 0.08 W/^{o}C						
$T_A \leqslant 25^oC$	1.75						W
$T_A > 25^oC$	Derate linearly 0.014 W/^{o}C						
T_{stg}, T_J	–65 to 150						^{o}C
T_L At distance 1/8 in.(3.17 mm) from case for 10 s max.	230						^{o}C

◆For p-n-p devices, voltage and current values are negative.

TERMINAL DESIGNATIONS



JEDEC TO-202AB

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25^{o}C*
RCP700 and RCP702 Series, P-N-P Types

CHARAC-TERISTIC SYMBOL	TEST CONDITIONS					LIMITS								UNITS
	VOLTAGE V dc			CURRENT A dc		RCP700A RCP702A		RCP700B RCP702B		RCP700C RCP702C		RCP700D RCP702D		
	V_{CB}	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
I_{CBO} I_E=0	–50 –70					– –	–0.5 –	– –	– –0.5	– –	–0.5 –	– –	– –0.5	μA
I_{CEO}		–30 –45			0 0	– –	–100 –	– –	– –100	– –	–100 –	– –	– –100	
I_{CEV}		–55 –85	1.5 1.5			– –	–100 –	– –	– –100	– –	–100 –	– –	– –100	
I_{EBO}			5	0		–	–100	–	–100	–	–100	–	–100	
h_{FE} RCP700 series RCP702 series Both series		–4 –4 –4		–0.5[a] –0.5[a] –1[a]		50 30 10	250 150 –	50 30 10	250 150 –	50 30 10	250 150 –	50 30 10	250 150 –	
$V_{CEO}(sus)$[b]				–0.1[a]	0	–40	–	–60	–	–80	–	–100	–	V
$V_{BE}(sat)$				–0.5[a]	–0.05	–	–1.2	–	–1.2	–	–1.2	–	–1.2	V
V_{BE}		–4		–0.5[a]		–	–1.1	–	–1.1	–	–1.1	–	–1.1	V
$V_{CE}(sat)$				–0.5[a]	–0.05	–	–0.8	–	–0.8	–	–0.8	–	–0.8	V
$\lvert h_{fe}\rvert$ f=10 MHz		–4		–0.05		5	–	5	–	5	–	5	–	
f_T		–4		–0.05		50	–	50	–	50	–	50	–	MHz
$I_{S/b}$ With base forward biased		–35 –50				–285 –	– –	– –150	– –	–150	–	–150	–	mA
C_{obo} f=1 MHz	–10					20	40	20	40	20	40	20	40	pF
t_{ON}	(V_{CC}) –30			0.5	I_{B_1}=–0.05 I_{B_2}=0.05	–	100	–	100	–	100	–	100	ns
t_{OFF}	(V_{CC}) –30			0.5	I_{B_1}=–0.05 I_{B_2}=0.05	–	1000	–	1000	–	1000	–	1000	
$R_{\theta JC}$ $R_{\theta JA}$						– –	12.5 71.4	– –	12.5 71.4	– –	12.5 71.4	– –	12.5 71.4	^{o}C/W

[a] Pulsed, pulse duration = 300 μs, duty factor ⩽ 2%. [b] *CAUTION:* Sustaining voltage, $V_{CEO}(sus)$, MUST NOT be measured on a curve tracer.

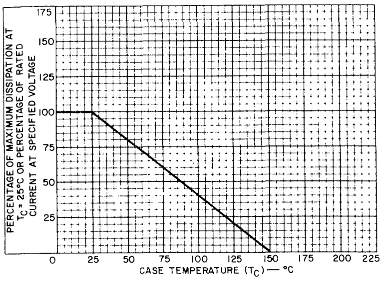


Fig. 1 - Dissipation derating curve for all types.

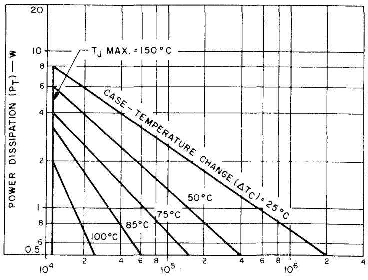
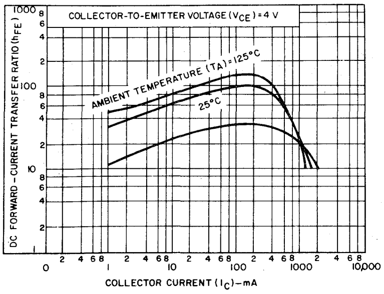


Fig. 2 - Thermal-cycling rating chart for all types.

RCP700, RCP702, RCP704, RCP706 Series
RCP701, RCP703, RCP705, RCP707 Series

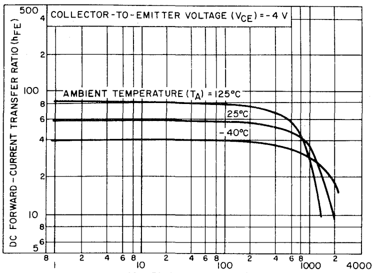
ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C*
RCP704, RCP705, RC?706, RCP707 Series N-P-N and P-N-P Types
RCP704 and RCP706 Series RCP705 and RCP707 Series

CHARAC-TERISTIC SYMBOL	TEST CONDITIONS◆					LIMITS								UNITS
	VOLTAGE V dc			CURRENT A dc		RCP704 RCP706		RCP704B RCP706B		RCP705 RCP707		RCP705B RCP707B		
	V_{CB}	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
I_{CBO} I_E=0	−40 −70					– –	−5 –	– –	– −5	– –	5 –	– –	– 5	µA
I_{CEO}		−22 −45			0 0	– –	−1000 –	– –	– −1000	– –	1000 –	– –	– 1000	
I_{CEV}		−45 −85	−1.5 −1.5			– –	−1000 –	– –	– −1000	– –	1000 –	– –	– 1000	
I_{EBO}			−5	0		–	−100	–	−100	–	100	–	100	
h_{FE} RCP704 RCP705 series RCP706 RCP707 series		−4 −4		−0.5[a] −0.5[a]		50 20	– –	50 20	– –	50 20	– –	50 20	– –	
V_{CEO}(sus)[b]				−0.1[a]	0	-30	–	−60	–	30	–	60	–	V
V_{BE}(sat)				−0.5[a]	−0.05	–	−1.6	–	−1.6	–	1.6	–	1.6	V
V_{BE}		−4		−0.5[a]		–	−1.5	–	−1.5	–	1.5	–	1.5	V
V_{CE}(sat)				−0.5[a]	−0.05	–	−1.2	–	−1.2	–	1.2	–	1.2	V
$\|h_{fe}\|$ f=10 MHz		−4		−0.05		5	–	5	–	5	–	5	–	
f_T		−4		−0.05		50	–	50	–	50	–	50	–	MHz
$I_{S/b}$ With base forward biased		−20 −50				−500 –	– –	– −200	– –	500 –	– –	– 120	– –	mA
C_{obo} f=1 MHz	−10					20	40	20	40	8	25	8	25	pF
t_{ON}	(V_{CC}) −30			0.5	I_{B_1}=−0.05 I_{B_2}=0.05	–	100	–	100	–	80	–	80	ns
t_{OFF}	(V_{CC}) −30			0.5	I_{B_1}=−0.05 I_{B_2}=0.05	–	1000	–	1000	–	800	–	800	
$R_{\theta JC}$ $R_{\theta JA}$						– –	12.5 71.4	– –	12.5 71.4	– –	12.5 71.4	– –	12.5 71.4	°C/W



92CS-24217

Fig. 3 - Typical static beta characteristics for RCP701, RCP703, RCP705, RCP707-series types.



92CS-24191

Fig. 4 - Typical static beta characteristics for RCP700, RCP702, RCP704, RCP706-series types.

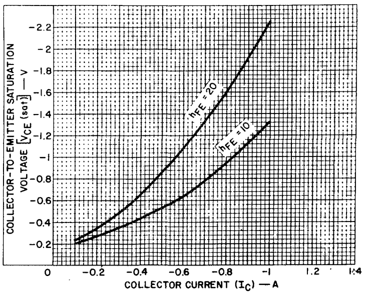
ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C*
RCP701 and RCP703 Series, N-P-N Types

CHARAC-TERISTIC SYMBOL	TEST CONDITIONS					LIMITS								UNITS
	VOLTAGE V dc			CURRENT A dc		RCP701A RCP703A		RCP701B RCP703B		RCP701C RCP703C		RCP701D RCP703D		
	V_{CB}	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
I_{CBO} I_E=0	50 70					– –	0.5 –	– –	– 0.5	– –	0.5 –	– –	– 0.5	µA
I_{CEO}		30 45			0 0	– –	100 –	– –	– 100	– –	100 –	– –	– 100	
I_{CEV}		55 85	−1.5 −1.5			– –	100 –	– –	– 100	– –	100 –	– –	– 100	
I_{EBO}			−5	0		–	100	–	100	–	100	–	100	
h_{FE} RCP701 series RCP703 series Both series		4 4 4		0.5[a] 0.5[a] 1[a]		50 30 10	250 150 –	50 30 10	250 150 –	50 30 10	250 150 –	50 30 10	250 150 –	
V_{CEO}(sus)[b]				0.1[a]	0	40	–	60	–	80	–	100	–	V
V_{BE}(sat)				0.5[a]	0.05	–	1.2	–	1.2	–	1.2	–	1.2	V
V_{BE}		4		0.5[a]		–	1.1	–	1.1	–	1.1	–	1.1	V
V_{CE}(sat)				0.5[a]	0.05	–	0.8	–	0.8	–	0.8	–	0.8	V
$\|h_{fe}\|$ f=10 MHz		4		0.05		5	–	5	–	5	–	5	–	
f_T		4		0.05		50	–	50	–	50	–	50	–	MHz
$I_{S/b}$ With base forward biased		20 50				500 –	– –	– 200	– –	200	–	200	–	mA
C_{obo} f=1 MHz	10					8	20	8	20	8	20	8	20	pF
t_{ON}	(V_{CC}) 30			0.5	I_{B_1}=0.05 I_{B_2}=−0.05	–	80	–	80	–	80	–	80	ns
t_{OFF}	(V_{CC}) 30			0.5	I_{B_1}=0.05 I_{B_2}=−0.05	–	800	–	800	–	800	–	800	
$R_{\theta JC}$ $R_{\theta JA}$						– –	12.5 71.4	– –	12.5 71.4	– –	12.5 71.4	– –	12.5 71.4	°C/W

[a] Pulsed, pulse duration = 300 µs, duty factor ⩽ 2%.

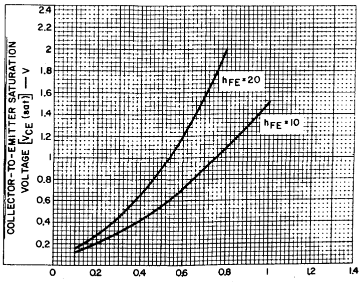
[b] *CAUTION:* Sustaining voltage, V_{CEO}(sus), MUST NOT be measured on a curve tracer.

◆ For p-n-p devices, voltage and current values are negative.



92CS-24192

Fig. 5 - Typical saturation-voltage characteristics for RCP700, RCP702, RCP704, RCP706-series types.



92CS-24215

Fig. 6 - Typical saturation-voltage characteristics for RCP701, RCP703, RCP705, RCP707-series types.

RCP700, RCP702, RCP704, RCP706 Series
RCP701, RCP703, RCP705, RCP707 Series

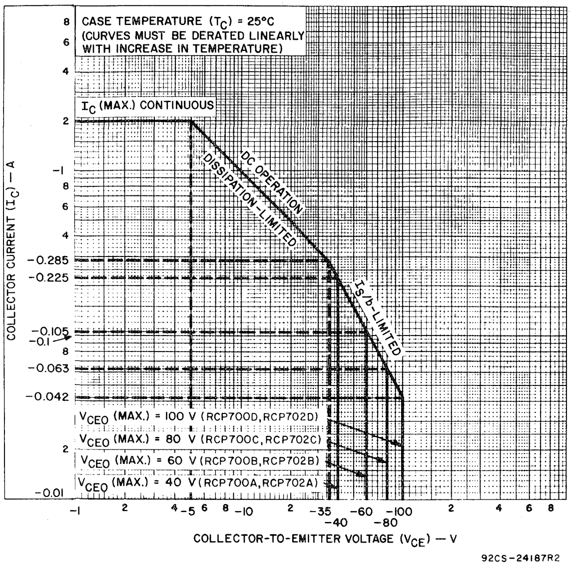


Fig. 7 - Maximum operating areas for RCP700-series and RCP702-series types.

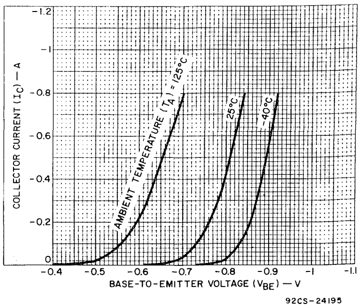


Fig. 8 - Typical transfer characteristics for RCP700, RCP702, RCP704, RCP706-series types.

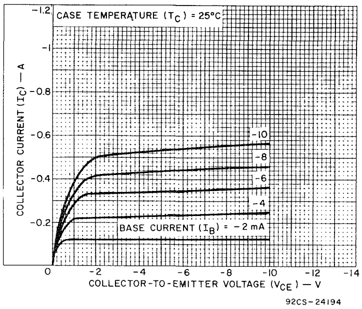


Fig. 9 - Typical output characteristics for RCP700, RCP702, RCP704, RCP706-series types.

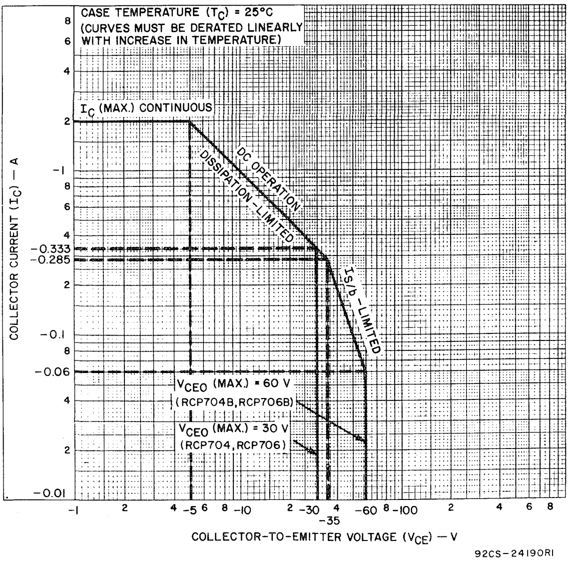


Fig. 10 - Maximum operating areas for RCP704-series and RCP706-series types.

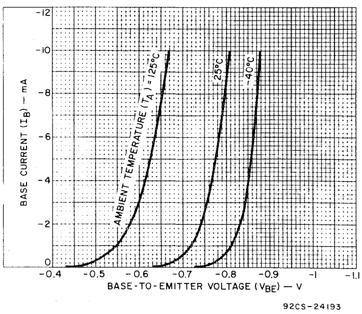
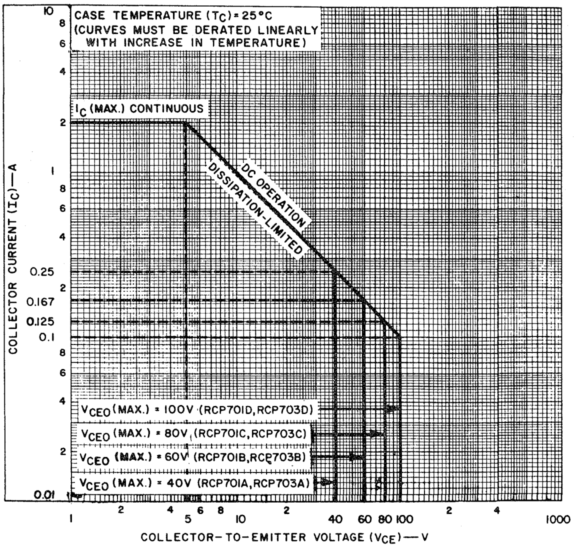
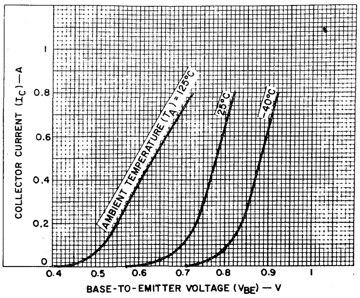


Fig. 11 - Typical input characteristics for RCP700, RCP702, RCP704, RCP706-series types.



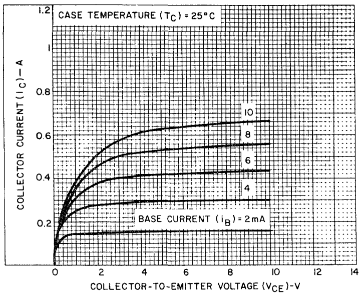
92CS-24218R2

Fig. 12 - Maximum operating areas for RCP701-series and RCP703-series types.



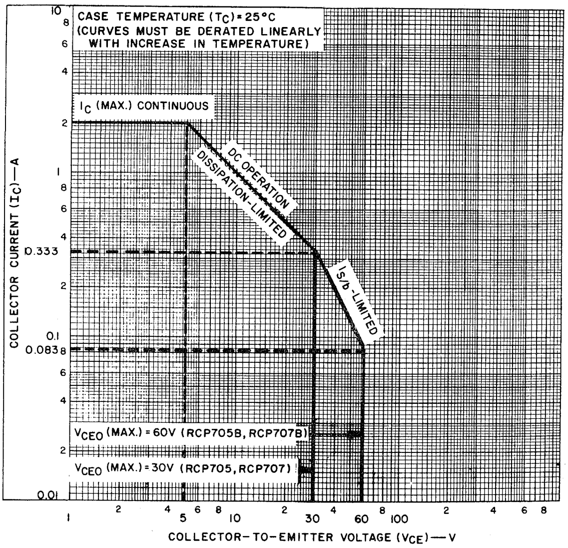
92CS-24235

Fig. 13 - Typical transfer characteristics for RCP701, RCP703, RCP705, RCP707-series types.



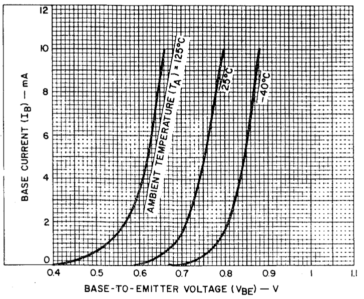
92CS-24216

Fig. 14 - Typical output characteristics for RCP701, RCP703, RCP705, RCP707-series types.



92CS-24219

Fig. 15 - Maximum operating areas for RCP705-series and RCP707-series types.



92CS-24214

Fig. 16 - Typical input characteristics for RCP701, RCP703, RCP705, RCP707-series types.

RCS683, RCS683A, RCS683B

4-Ampere Monolithic N-P-N Darlington Power Transistors

40-60-80 Volts, 10 Watts
Gain of 1000 at 2 A

Features:
- Operates from 1C without predriver
- Low leakage at high temperature
- High reverse second-breakdown capability

Applications:
- Power switching
- Audio amplifiers
- Hammer drivers
- Series and shunt regulators

The RCS683, RCS683A, and RCS683B● are monolithic n-p-n silicon Darlington transistors designed for low- and medium-frequency power applications. The double epitaxial construction of these devices provides good forward and reverse second-breakdown capability; their high gain makes it possible for them to be driven directly from integrated circuits; and their small package (TO-39) permits compact design.

● Formerly RCA Dev. Nos. TA8698C, TA8698B, and TA8698A, respectively.

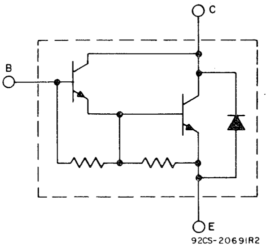
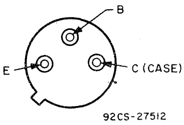


Fig. 1 – Schematic diagram for all types.

TERMINAL DESIGNATIONS



JEDEC TO-39

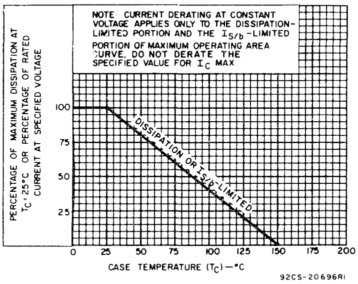


Fig. 2 – Derating curve.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	RCS683	RCS683A	RCS683B	
V_{CBO}	40	60	80	V
$V_{CER}(sus)$				
R_{BE} = 100 Ω	40	60	80	V
$V_{CEO}(sus)$	40	60	80	V
V_{CEX}				
V_{BE} = -1.5 V, R_{BB} = 100 Ω	40	60	80	V
V_{EBO}		5		V
I_C		4		A
I_{CM}		6		A
I_B		0.1		A
P_T				
$T_C \leq$ 25°C		10		W
$T_C >$ 25°C		derate linearly at 0.08		W/°C
T_{stg}		-65 to +200		°C
T_J		-65 to +150		°C
T_L				
At distances ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max.		235		°C

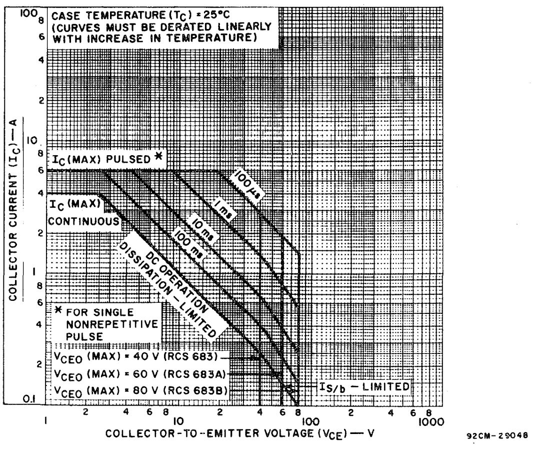


Fig. 3 – Maximum operating area.

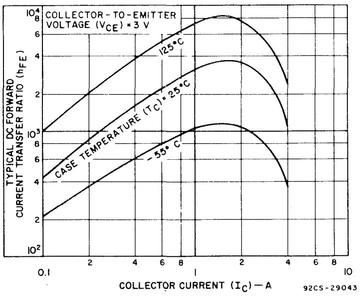


Fig. 4 – Typical DC beta characteristics.

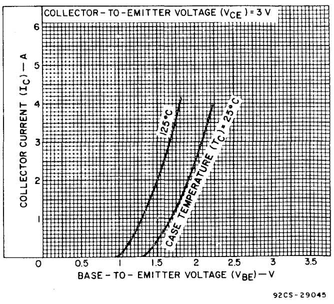


Fig. 5 – Typical transfer characteristics.

RCS683, RCS683A, RCS683B

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC SYMBOL	TEST CONDITIONS				LIMITS						UNITS
	VOLTAGE V dc		CURRENT A dc		RCS683		RCS683A		RCS683B		
	V_{CE}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
I_{CEO}	40			0	–	1	–	–	–	–	
	60			0	–	–	–	1	–	–	
	80			0	–	–	–	–	–	1	
I_{CEV}	40	-1.5			–	0.15	–	–	–	–	mA
	60	-1.5			–	–	–	0.15	–	–	
	80	-1.5			–	–	–	–	–	0.15	
T_C = 125°C	40	-1.5			–	1.5	–	–	–	–	
	60	-1.5			–	–	–	1.5	–	–	
	80	-1.5			–	–	–	–	–	1.5	
I_{EBO}		-5	0		–	2	–	2	–	2	
$V_{CEO}(sus)$			0.1[a]	0	40	–	60	–	80	–	V
h_{FE}	3		2[a]		1000	–	1000	–	1000	–	
	3		4[a]		200	–	200	–	200	–	
V_{BE}	3		2[a]		–	2.4	–	2.4	–	2.4	V
	3		4[a]		–	4	–	4	–	4	
$V_{CE}(sat)$			2[a]	0.004	–	1.6	–	1.6	–	1.6	
			4[a]	0.04	–	2.8	–	2.8	–	2.8	
V_F			-4		–	3	–	3	–	3	
$\|h_{fe}\|$ f = 1 MHz	5		1		20	–	20	–	20	–	
C_{obo}	V_{CB} = 10			$I_E = 0$	–	60	–	60	–	60	pF
$E_{S/b}$[b] L = 12 mH, R_{BE} = 100 Ω		-1.5			30	–	30	–	30	–	mJ
$I_{S/b}$ t = 0.5 s non rep.	35				0.28	–	–	–	–	–	
	55				–	–	0.17	–	–	–	A
	75				–	–	–	–	0.11	–	
$R_{\theta JC}$					–	12.5	–	12.5	–	12.5	°C/W

[a] Pulsed: Pulse duration = 300 μs, duty factor = 2%.

[b] $E_{S/b}$ is defined as the energy at which second breakdown occurs under specified reverse bias conditions.
$E_{S/b} = 1/2LI^2$ where L is a series load or leakage inductance, and I is the peak collector current.

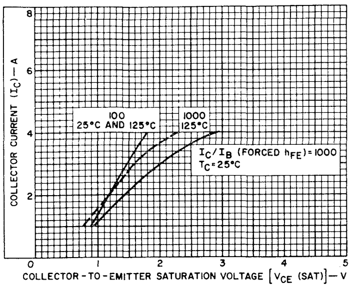


Fig. 6 — Typical saturation characteristics.

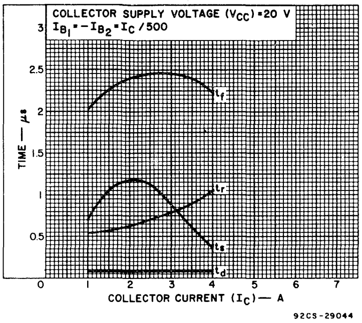


Fig. 7 — Typical saturated switching time characteristics.

TIP29, TIP29A, TIP29B, TIP29C

Epitaxial-Base, Silicon N-P-N VERSAWATT Transistors

For Power-Amplifier and High-Speed-Switching Applications

The RCA-TIP29, TIP29A, TIP29B, and TIP-29C are epitaxial-base, silicon n-p-n transistors intended for a wide variety of switching and amplifier applications, such as series and shunt regulators and driver and output stages of high-fidelity amplifiers. These power transistors are designed for complementary use with devices in the TIP30 series.

They differ from each other in voltage ratings.

They are supplied in the JEDEC TO-220AB straight-lead version of the VERSAWATT package, and can be provided in formed-lead configurations upon request.

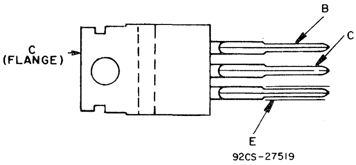
Features:

- **30 W at 25°C case temperature**
- **3 A rated collector current**
- **Min. f_T of 3 MHz at 10 V, 200 mA**
- **Designed for complementary use with TIP30-series p-n-p types**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	TIP29	TIP29A	TIP29B	TIP29C	
V_{CBO}	40	60	80	100	V
V_{CEO}	40	60	80	100	V
V_{EBO}	5	5	5	5	V
I_C	3	3	3	3	A
I_B	1	1	1	1	A
P_T:					
At $T_C \leq 25°C$	30	30	30	30	W
At $T_A \leq 25°C$	2	2	2	2	W
At $T_C > 25°C$ Derate linearly	0.24				W/°C
T_{stg}, T_J	−65 to 150				°C
T_L (During soldering):					
At distance 1/8 in. (3.17 mm) from case for 10 s max.	235				°C

TERMINAL CONNECTIONS



JEDEC TO-220AB

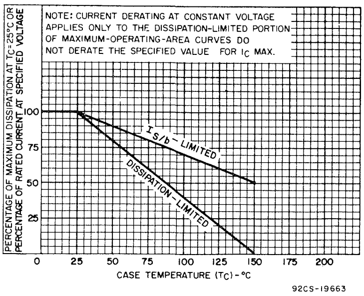


Fig.2 — Derating curve for all types.

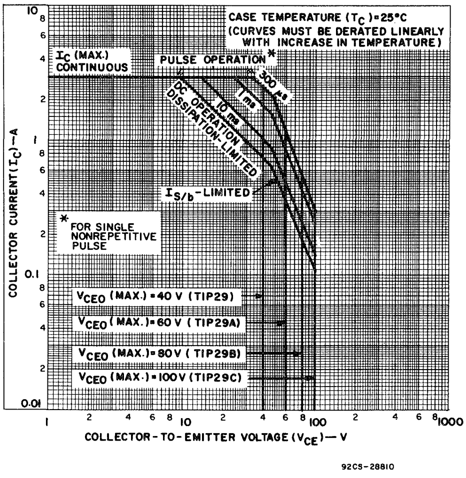


Fig.1 — Maximum operating areas for all types.

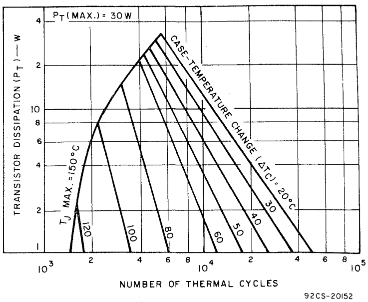


Fig.3 — Thermal-cycling ratings for all types.

TIP29, TIP29A, TIP29B, TIP29C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	TEST COND.		LIMITS								Units
	VOLTAGE V dc	CURRENT A dc	TIP29		TIP29A		TIP29B		TIP29C		
	V_{CE}	I_C	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
I_{CEO}	30		–	0.3	–	0.3	–	–	–	–	
$I_B=0$	60		–	–	–	–	–	0.3	–	0.3	mA
I_{CES}	40		–	0.2	–	–	–	–	–	–	mA
$V_{EB}=0$	60		–	–	–	0.2	–	–	–	–	
	80		–	–	–	–	–	0.2	–	–	
	100		–	–	–	–	–	–	–	0.2	
I_{EBO} $V_{BE}=-5V$		0	–	1	–	1	–	1	–	1	mA
$V_{CEO}(sus)$ $I_B=0$		0.03[a]	40[b]	–	60[b]	–	80[b]	–	100[b]	–	V
h_{FE}	4	0.2[a]	40	–	40	–	40	–	40	–	
	4	1[a]	15	150	15	150	15	150	15	150	
V_{BE}	4	1[a]	–	1.3	–	1.3	–	1.3	–	1.3	V
$V_{CE}(sat)$ $I_B=$ 0.125A		1[a]	–	0.7	–	0.7	–	0.7	–	0.7	V
h_{fe} f=1 kHz	10	0.2	20	–	20	–	20	–	20	–	
$\|h_{fe}\|$ f=1 MHz	10	0.2	3	–	3	–	3	–	3	–	
t_{ON} (t_d+t_r) $V_{CC}=$ 30V $R_L=30\Omega$ $I_{B1}=I_{B2}$ =0.1A		1	0.4 (typ.)		0.4 (typ.)		0.4 (typ.)		0.4 (typ.)		μs
t_{OFF} (t_s+t_f) $V_{CC}=$ 30V $R_L=30\Omega$ $I_{B1}=-I_{B2}$ =0.1A		1	1.2 (typ.)		1.2 (typ.)		1.2 (typ.)		1.2 (typ.)		μs
$R_{\theta JC}$			–	4.17	–	4.17	–	4.17	–	4.17	°C/W
$R_{\theta JA}$			–	62.5	–	62.5	–	62.5	–	62.5	°C/W

[a] Pulsed, pulse duration = 300 μs, duty factor ≤ 2%.

[b] *CAUTION:* Sustaining voltage, $V_{CEO}(sus)$, *MUST NOT* be measured on a curve tracer.

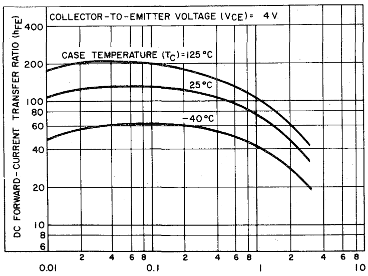


Fig.4 — Typical dc beta characteristics for TIP29, TIP29A, and TIP29B.

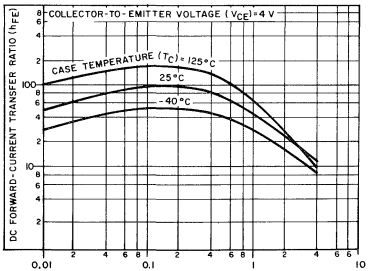


Fig.5 — Typical dc beta characteristics for TIP29C.

TIP30, TIP30A, TIP30B, TIP30C

Epitaxial-Base, Silicon P-N-P VERSAWATT Transistors

For Power-Amplifier and High-Speed-Switching Applications

The RCA-TIP30, TIP30A, TIP30B, and TIP30C are epitaxial-base, silicon p-n-p transistors intended for a wide variety of switching and amplifier applications, such as series and shunt regulators and driver and output stages of high-fidelity amplifiers. These power transistors are designed for complementary use with devices in the TIP29 series. They differ from each other in voltage ratings.

They are supplied in the JEDEC TO-220AB straight-lead version of the VERSAWATT package, and can be provided in formed-lead configurations upon request.

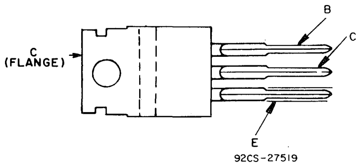
Features:

- **30 W at 25°C case temperature**
- **3 A rated collector current**
- **Min. f_T of 3 MHz at −10 V, −200 mA**
- **Designed for complementary use with TIP29-series n-p-n types**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	TIP30	TIP30A	TIP30B	TIP30C	
V_{CBO}	−40	−60	−80	−100	V
V_{CEO}	−40	−60	−80	−100	V
V_{EBO}	−5	−5	−5	−5	V
I_C	−3	−3	−3	−3	A
I_B	−1	−1	−1	−1	A
P_T:					
At $T_C \leqslant 25°C$	30	30	30	30	W
At $T_A \leqslant 25°C$	2	2	2	2	W
At $T_C > 25°C$ Derate linearly	0.24				W/°C
T_{stg}, T_J	−65 to 150				°C
T_L (During soldering): At distance 1/8 in. (3.17 mm) from case for 10 s max.	235				°C

TERMINAL DESIGNATIONS



JEDEC TO-220AB

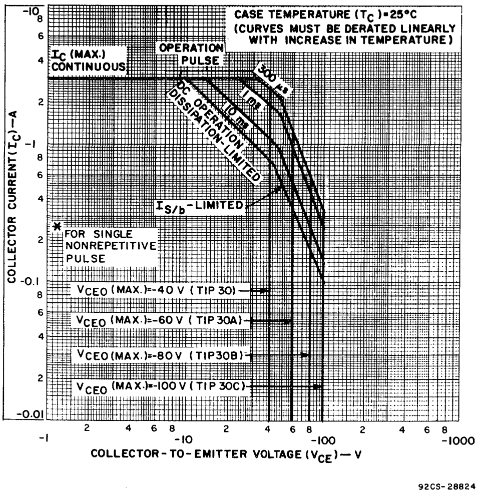


Fig. 1 — Maximum operating areas for all types.

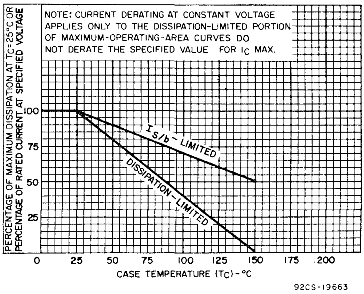


Fig. 2 — Derating curve for all types.

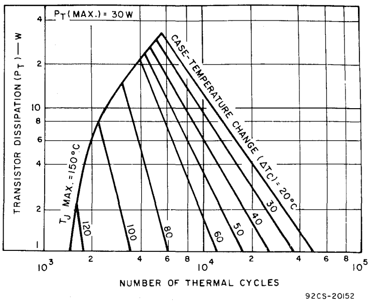


Fig. 3 — Thermal-cycling ratings for all types.

TIP30, TIP30A, TIP30B, TIP30C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARAC-TERISTIC	TEST COND. VOLT-AGE V dc	CUR-RENT A dc	LIMITS TIP30		TIP30A		TIP30B		TIP30C		Units
	V_{CE}	I_C	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
I_{CEO} $I_B=0$	−30 −60		– –	−0.3 –	– –	−0.3 –	– –	– −0.3	– –	– −0.3	mA
I_{CES} $V_{EB}=0$	−40 −60 −80 −100		– – – –	−0.2 – – –	– – – –	– −0.2 – –	– – – –	– – −0.2 –	– – – –	– – – −0.2	mA
I_{EBO} $V_{BE}=5V$		0	–	−1	–	−1	–	−1	–	−1	mA
$V_{CEO}(sus)$ $I_B=0$		−0.03[a]	−40[b]	–	−60[b]	–	−80[b]	–	−100[b]	–	V
h_{FE}	−4 −4	−0.2[a] −1[a]	40 15	– 150	40 15	– 150	40 15	– 150	40 15	– 150	
V_{BE}	−4	−1[a]	–	−1.3	–	−1.3	–	−1.3	–	−1.3	V
$V_{CE}(sat)$ $I_B=$ −0.125A		−1[a]	–	−0.7	–	−0.7	–	−0.7	–	−0.7	V
h_{fe} f=1 kHz	−10	−0.2	20	–	20	–	20	–	20	–	
$\|h_{fe}\|$ f=1 MHz	−10	−0.2	3	–	3	–	3	–	3	–	
t_{ON} (t_d+t_r) $V_{CC}=$ −30V $R_L=30\Omega$ $I_{B1}=-I_{B2}$ =−0.1A		−1	0.2 (typ.)		0.2 (typ.)		0.2 (typ.)		0.2 (typ.)		µs
t_{OFF} (t_s+t_f) $V_{CC}=$ −30V $R_L=30\Omega$ $I_{B1}=I_{B2}$ =−0.1A		−1	1 (typ.)		1 (typ.)		1 (typ.)		1 (typ.)		
$R_{\theta JC}$			–	4.17	–	4.17	–	4.17	–	4.17	°C/W
$R_{\theta JA}$			–	62.5	–	62.5	–	62.5	–	62.5	

[a] Pulsed, pulse duration = 300 µs, duty factor ⩽ 2%.

[b] *CAUTION:* Sustaining voltage, $V_{CEO}(sus)$, *MUST NOT* be measured on a curve tracer.

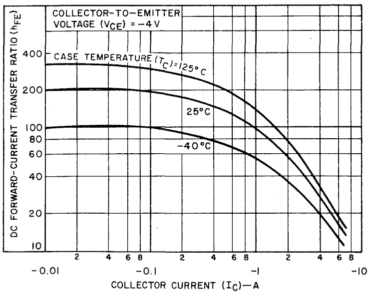


Fig.4 – Typical dc beta characteristics for TIP30, TIP30A, and TIP30B

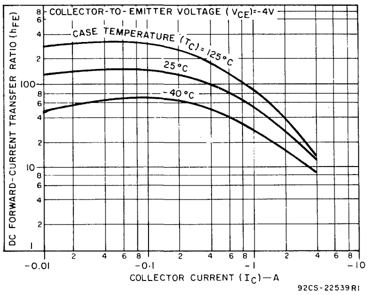


Fig.5 – Typical dc beta characteristics for TIP30C.

TIP31, TIP31A, TIP31B, TIP31C

Epitaxial-Base, Silicon N-P-N VERSAWATT Transistors

For Power-Amplifier and High-Speed-Switching Applications

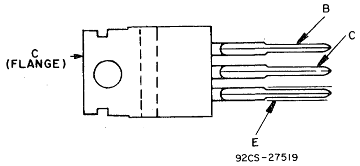
The RCA-TIP31, TIP31A, TIP31B, and TIP31C are epitaxial-base, silicon n-p-n transistors intended for a wide variety of switching and amplifier applications, such as series and shunt regulators and driver and output stages of high-fidelity amplifiers. These power transistors are designed for complementary use with devices in the TIP32 series. They differ from each other in voltage ratings.

They are supplied in the JEDEC TO-220AB straight-lead version of the VERSAWATT package and can be provided in formed-lead configurations upon request.

Features:

- **40 W at 25°C case temperature**
- **5 A rated collector current**
- **Min. f_T of 3 MHz at 10 V, 500 mA**
- **Designed for complementary use with TIP32-series p-n-p types**

TERMINAL DESIGNATIONS



JEDEC TO-220AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	TIP31	TIP31A	TIP31B	TIP31C	
V_{CBO}	40	60	80	100	V
V_{CEO}	40	60	80	100	V
V_{EBO}	5	5	5	5	V
I_C	5	5	5	5	A
I_B	1	1	1	1	A
P_T:					
At $T_C \leq 25°C$	40	40	40	40	W
At $T_A \leq 25°C$	2	2	2	2	W
At $T_C > 25°C$ Derate linearly	0.32				W/°C
T_{stg}, T_J	-65 to 150				°C
T_L (During soldering):					
At distance 1/8 in. (3.17 mm) from case for 10 s max.	235				°C

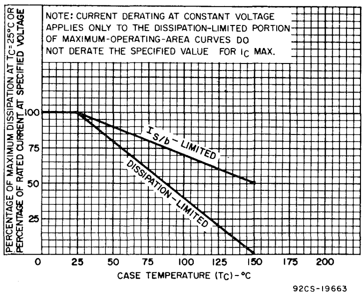


Fig.2 — Derating curve for all types.

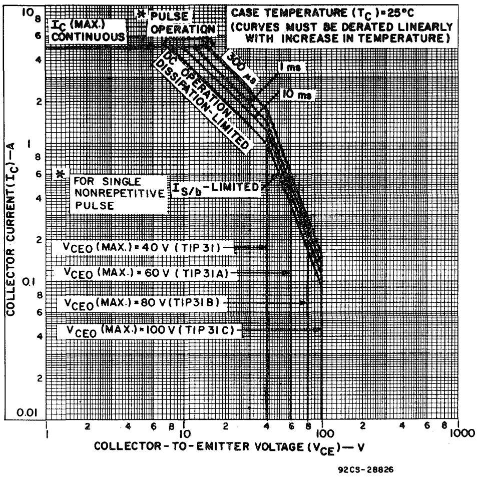


Fig.1 — Maximum operating areas for all types.

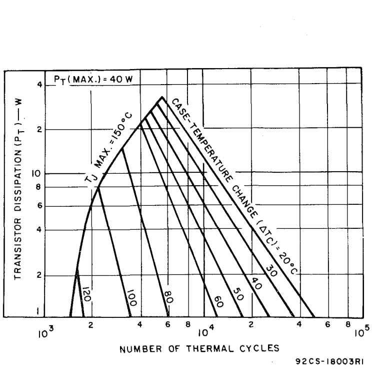


Fig.3 — Thermal-cycling ratings for all types.

TIP31, TIP31A, TIP31B, TIP31C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARAC-TERISTIC	TEST COND.		LIMITS								Units
	VOLT-AGE V dc	CUR-RENT A dc	TIP31		TIP31A		TIP31B		TIP31C		
	V_{CE}	I_C	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
I_{CEO} $I_B=0$	30 60		– –	0.3 –	– –	0.3 –	– –	– 0.3	– –	– 0.3	mA
I_{CES} $V_{EB}=0$	40 60 80 100		– – – –	0.2 – – –	– – – –	– 0.2 – –	– – – –	– – 0.2 –	– – – –	– – – 0.2	mA
I_{EBO} $V_{BE}=-5V$		0	–	1	–	1	–	1	–	1	mA
$V_{CEO}(sus)$ $I_B=0$		0.03^a	40^b	–	60^b	–	80^b	–	100^b	–	V
h_{FE}	4 4	1^a 3^a	25 10	– 50	25 10	– 50	25 10	– 50	25 10	– 50	
V_{BE}	4	3^a	–	1.8	–	1.8	–	1.8	–	1.8	V
$V_{CE}(sat)$ $I_B=$ 0.375A		3^a	–	1.2	–	1.2	–	1.2	–	1.2	V
h_{fe} f=1 kHz	10	0.5	20	–	20	–	20	–	20	–	
$\|h_{fe}\|$ f=1 MHz	10	0.5	3	–	3	–	3	–	3	–	
t_{ON} (t_d+t_r) $V_{CC}=$ 30V $R_L=30\Omega$ $I_{B1}=I_{B2}$ =0.1A		1	0.4 (typ.)		0.4 (typ.)		0.4 (typ.)		0.4 (typ.)		µs
t_{OFF} (t_s+t_f) $V_{CC}=$ 30V $R_L=30\Omega$ $I_{B1}=-I_{B2}$ =0.1A		1	1.2 (typ.)		1.2 (typ.)		1.2 (typ.)		1.2 (typ.)		
$R_{\theta JC}$			–	3.125	–	3.125	–	3.125	–	3.125	°C/W
$R_{\theta JA}$			–	62.5	–	62.5	–	62.5	–	62.5	

[a] Pulsed, pulse duration = 300 µs, duty factor ≤ 2%.

[b] *CAUTION:* Sustaining voltage, $V_{CEO}(sus)$, *MUST NOT* be measured on a curve tracer.

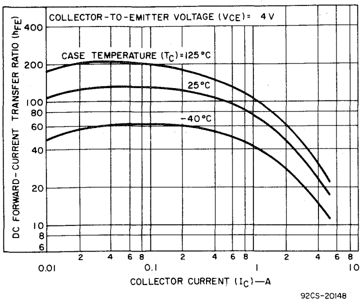


Fig.4 — Typical dc beta characteristics for TIP31, TIP31A, and TIP31B.

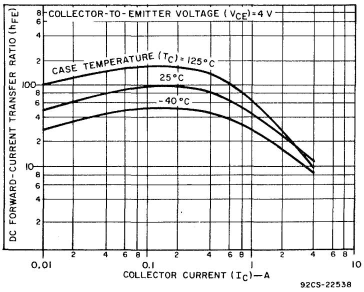


Fig.5 — Typical dc beta characteristics for TIP31C.

TIP32, TIP32A, TIP32B, TIP32C

Epitaxial-Base, Silicon P-N-P VERSAWATT Transistors

For Power-Amplifier and High-Speed-Switching Applications

The RCA-TIP32, TIP32A, TIP32B, and TIP32C are epitaxial-base, silicon p-n-p transistors intended for a wide variety of switching and amplifier applications, such as series and shunt regulators and driver and output stages of high-fidelity amplifiers. These power transistors are designed for complementary use with devices in the TIP31 series. They differ from each other in voltage ratings.

They are supplied in the JEDEC TO-220AB straight-lead version of the VERSAWATT package, and can be provided in formed-lead configurations upon request.

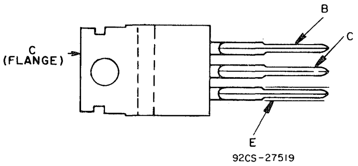
Features:

- **40 W at 25°C case temperature**
- **5 A rated collector current**
- **Min. f_T of 3 MHz at −10 V, −500 mA**
- **Designed for complementary use with TIP31-series n-p-n types**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	TIP32	TIP32A	TIP32B	TIP32C	
V_{CBO}	−40	−60	−80	−100	V
V_{CEO}	−40	−60	−80	−100	V
V_{EBO}	−5	−5	−5	−5	V
I_C	−5	−5	−5	−5	A
I_B	−1	−1	−1	−1	A
P_T:					
At $T_C \leq 25°C$	40	40	40	40	W
At $T_A \leq 25°C$	2	2	2	2	W
At $T_C > 25°C$ Derate linearly	0.32				W/°C
T_{stg}, T_J	−65 to 150				°C
T_L (During soldering):					
At distance 1/8 in. (3.17 mm) from case for 10 s max.	235				°C

TERMINAL DESIGNATIONS



JEDEC TO-220AB

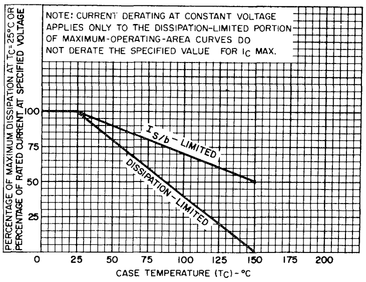


Fig.2 — Derating curve for all types.

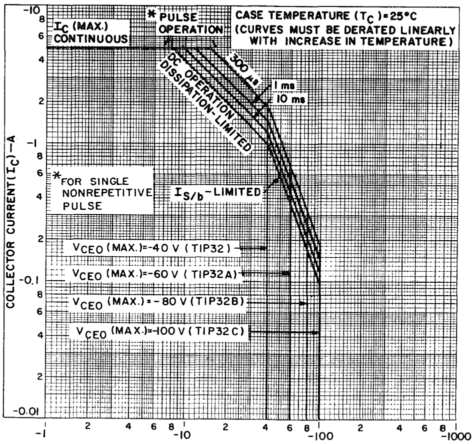


Fig.1 — Maximum operating areas for all types.

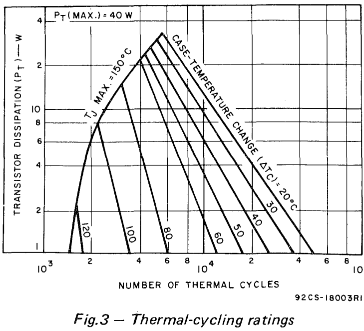


Fig.3 — Thermal-cycling ratings for all types.

TIP32, TIP32A, TIP32B, TIP32C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	TEST COND.		LIMITS								Units
	VOLTAGE V dc	CURRENT A dc	TIP32		TIP32A		TIP32B		TIP32C		
	V_{CE}	I_C	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
I_{CEO} I_B=0	−30 −60		– –	−0.3 –	– –	−0.3 –	– –	– −0.3	– –	– −0.3	mA
I_{CES} V_{EB}=0	−40 −60 −80 −100		– – – –	−0.2 – – –	– – – –	– −0.2 – –	– – – –	– – −0.2 –	– – – –	– – – −0.2	mA
I_{EBO} V_{BE}=5V		0	–	−1	–	−1	–	−1	–	−1	mA
V_{CEO}(sus) I_B=0		−0.03[a]	−40[b]	–	−60[b]	–	−80[b]	–	−100[b]	–	V
h_{FE}	−4 −4	−1[a] −3[a]	25 10	– 50	25 10	– 50	25 10	– 50	25 10	– 50	
V_{BE}	−4	−3[a]	–	−1.8	–	−1.8	–	−1.8	–	−1.8	V
V_{CE}(sat) I_B= −0.375A		−3[a]	–	−1.2	–	−1.2	–	−1.2	–	−1.2	V
h_{fe} f=1 kHz	−10	−0.5	20	–	20	–	20	–	20	–	
$\|h_{fe}\|$ f=1 MHz	−10	−0.5	3	–	3	–	3	–	3	–	
t_{ON} (t_d+t_r) V_{CC}= −30V R_L=30Ω I_{B1}=I_{B2} =−0.1A		−1	0.2 (typ.)		0.2 (typ.)		0.2 (typ.)		0.2 (typ.)		µs
t_{OFF} (t_s+t_f) V_{CC}= −30V R_L=30Ω I_{B1}=−I_{B2} =−0.1A		−1	1 (typ.)		1 (typ.)		1 (typ.)		1 (typ.)		
$R_{\theta JC}$			–	3.125	–	3.125	–	3.125	–	3.125	°C/W
$R_{\theta JA}$			–	62.5	–	62.5	–	62.5	–	62.5	

[a] Pulsed, pulse duration = 300 µs, duty factor ⩽ 2%.

[b] *CAUTION:* Sustaining voltage, V_{CEO}(sus), *MUST NOT* be measured on a curve tracer.

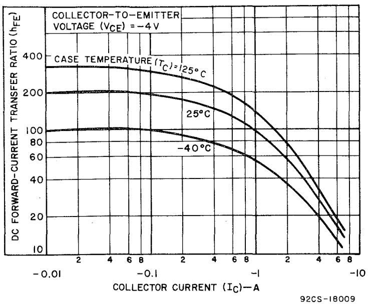


Fig.4 — Typical dc beta characteristics for TIP32, TIP32A, and TIP32B.

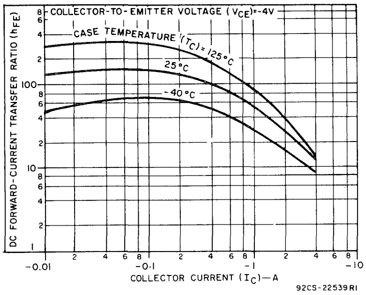


Fig.5 — Typical dc beta characteristics for TIP32C.

TIP41, TIP41A, TIP41B, TIP41C

Epitaxial-Base, Silicon N-P-N VERSAWATT Transistors

For Power-Amplifier and High-Speed-Switching Applications

The RCA-TIP41, TIP41A, TIP41B, and TIP41C are epitaxial-base, silicon n-p-n transistors intended for a wide variety of switching and amplifier applications, such as series and shunt regulators and driver and output stages of high-fidelity amplifiers. These power transistors are designed for complementary use with devices in the TIP42-series. They differ from each other in voltage ratings. They are supplied in the JEDEC TO-220AB straight-lead version of the VERSAWATT package, and can be provided in formed-lead configurations upon request.

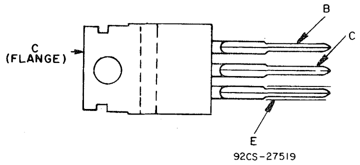
Features:

- **65 W at 25°C case temperature**
- **7-A rated collector current**
- **Min. f_T of 3 MHz at 10 V, 500 mA**
- **Designed for complementary use with TIP42-series p-n-p types**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	TIP41	TIP41A	TIP41B	TIP41C	
V_{CBO}	40	60	80	100	V
V_{CEO}	40	60	80	100	V
V_{EBO}	5	5	5	5	V
I_C	7	7	7	7	A
I_{CM}	10	10	10	10	A
I_B	3	3	3	3	A
P_T:					
At $T_C \leq 25°C$	65	65	65	65	W
At $T_A \leq 25°C$	2	2	2	2	W
At $T_C > 25°C$ Derate linearly at	0.52				W/°C
T_{stg}, T_J	−65 to 150				°C
T_L (During soldering): At distance 1/8 in. (3.17 mm) from case for 10 s max.	235				°C

TERMINAL DESIGNATIONS



JEDEC TO-220AB

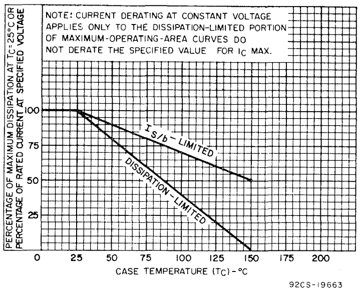


Fig. 2 — Derating curves for all types.

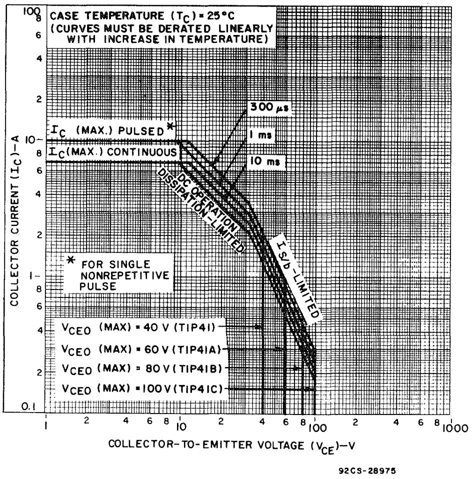


Fig. 1 — Maximum operating areas for all types.

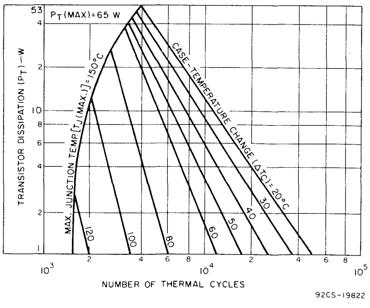


Fig. 3 — Thermal-cycling ratings for all types.

TIP41, TIP41A, TIP41B, TIP41C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C*

CHARACTERISTIC	TEST CONDITIONS		LIMITS								Units
	Voltage V dc	Current A dc	TIP41		TIP41A		TIP41B		TIP41C		
	V_{CE}	I_C	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
I_{CEO} I_B=0	30		–	0.7	–	0.7	–	–	–	–	mA
	60		–	–	–	–	–	0.7	–	0.7	
I_{CES} V_{BE}=0	40		–	0.4	–	–	–	–	–	–	mA
	60		–	–	–	0.4	–	–	–	–	
	80		–	–	–	–	–	0.4	–	–	
	100		–	–	–	–	–	–	–	0.4	
I_{EBO} V_{BE}=–5 V		0	–	1	–	1	–	1	–	1	mA
V_{CEO}(sus) I_B=0		0.03[a]	40[b]	–	60[b]	–	80[b]	–	100[b]	–	V
h_{FE}	4	0.3[a]	30	–	30	–	30	–	30	–	
	4	3[a]	15	150	15	150	15	150	15	150	
V_{BE}	4	6[a]	–	2.2	–	2.2	–	2.2	–	2.2	V
V_{CE}(sat) I_B=0.6 A		6[a]	–	2	–	2	–	2	–	2	V
h_{fe} f=1 kHz	10	0.5	20	–	20	–	20	–	20	–	
$\|h_{fe}\|$ f=1 MHz	10	0.5	3	–	3	–	3	–	3	–	
t_{ON} ($t_d + t_r$) V_{CC}=30 V, R_L=5 Ω, I_{B1}=I_{B2}=0.6 A		6	0.6 (typ.)		0.6 (typ.)		0.6 (typ.)		0.6 (typ.)		μs
t_{OFF} ($t_s + t_f$) V_{CC}=30 V, R_L=5 Ω, I_{B1}=I_{B2}=0.6 A		6	1.4 (typ.)		1.4 (typ.)		1.4 (typ.)		1.4 (typ.)		
$R_{\theta JC}$			–	1.92	–	1.92	–	1.92	–	1.92	°C/W
$R_{\theta JA}$			–	62.5	–	62.5	–	62.5	–	62.5	

[a] Pulsed, pulse duration = 300 μs, duty factor ⩽ 2%.

[b] *CAUTION: Sustaining voltage, V_{CEO}(sus), MUST NOT be measured on a curve tracer.*

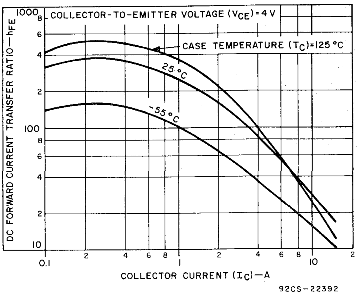


Fig. 4 — Typical dc beta characteristics for all types.

TIP42, TIP42A, TIP42B, TIP42C

Epitaxial-Base, Silicon P-N-P VERSAWATT Transistors

For Power-Amplifier and High-Speed-Switching Applications

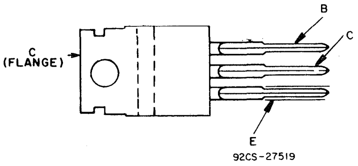
The RCA-TIP42, TIP42A, TIP42B, and TIP42C are epitaxial-base silicon p-n-p transistors intended for a wide variety of switching and amplifier applications, such as series and shunt regulators and driver and output stages of high-fidelity amplifiers. These power transistors are designed for complementary use with devices in the TIP41-series. They differ from each other in voltage ratings.

They are supplied in the JEDEC TP-220AB straight-lead version of the VERSAWATT package, and can be provided in formed-lead configurations upon request.

Features:

- **65 W at 25°C case temperature**
- **7 A rated collector current**
- **Min. f_T of 3 MHz at 10 V, 500 mA**
- **Designed for complementary use with TIP41-series n-p-n types**

TERMINAL DESIGNATIONS



JEDEC TO-220AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	TIP42	TIP42A	TIP42B	TIP42C	
V_{CBO}	-40	-60	-80	-100	V
V_{CEO}	-40	-60	-80	-100	V
V_{EBO}	- 5	- 5	- 5	- 5	V
I_C	- 7	- 7	- 7	- 7	A
I_{CM}	-10	-10	-10	- 10	A
I_B	- 3	- 3	- 3	- 3	A
P_T:					
At $T_C \leqslant 25°C$	65	65	65	65	W
At $T_A \leqslant 25°C$	2	2	2	2	W
At $T_C > 25°C$ Derate linearly at	0.52				W/°C
T_{stg}, T_J	-65 to 150				°C
T_L (During soldering):					
At distance 1/8 in. (3.17 mm) from case for 10 s max.	235				°C

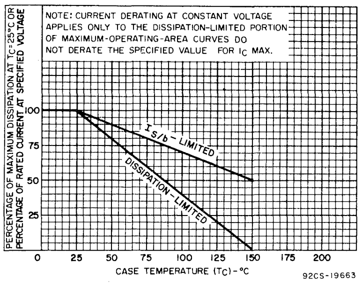


Fig. 2 — Derating curve for all types.

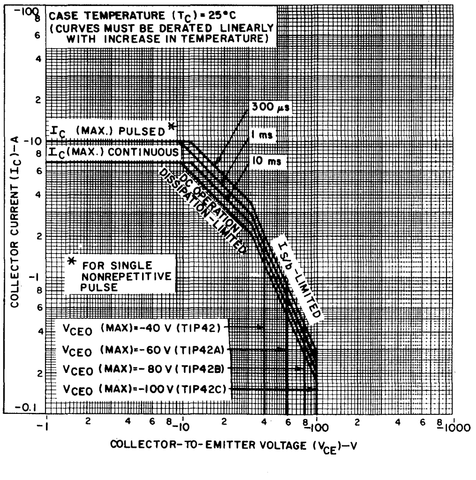


Fig. 1 — Maximum operating areas for all types.

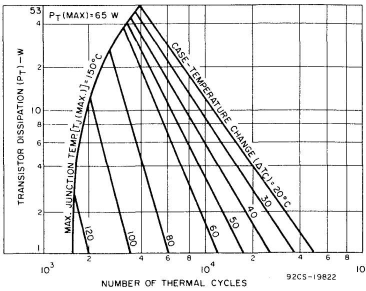


Fig. 3 — Thermal-cycling ratings for all types.

TIP42, TIP42A, TIP42B, TIP42C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C*

CHARACTER-ISTICS	TEST COND.		LIMITS								UNITS
	VOLT-AGE V dc	CUR-RENT A dc	TIP42		TIP42A		TIP42B		TIP42C		
	V_{CE}	I_C	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
I_{CEO} $I_B = 0$	- 30		–	-0.7	–	-0.7	–	–	–	–	mA
	- 60		–	–	–	–	–	-0.7	–	-0.7	
I_{CES} $V_{EB} = 0$	- 40		–	-0.4	–	–	–	–	–	–	mA
	- 60		–	–	–	-0.4	–	–	–	–	
	- 80		–	–	–	–	–	-0.4	–	–	
	-100		–	–	–	–	–	–	–	-0.4	
I_{EBO} $V_{BE} = -5$ V		0	–	-1	–	-1	–	-1	–	-1	mA
V_{CEO}(sus) $I_B = 0$		-0.03[a]	-40[b]	–	-60[b]	–	-80[b]	–	-100[b]	–	V
h_{FE}	- -4	-0.3[a]	30	–	30	–	30	–	30	–	
	-4	-3[a]	15	150	15	150	15	150	15	150	
V_{BE}	-4	-6[a]	–	-2.2	–	-2.2	–	-2.2	–	-2.2	V
V_{CE}(sat) $I_B = -0.6$ A		-6[a]	–	-2	–	-2	–	-2	–	-2	V
h_{fe} f = 1 kHz	-10	-0.5	20	–	20	–	20	–	20	–	
$\lvert h_{fe} \rvert$ f = 1 MHz	-10	-0.5	3	–	3	–	3	–	3	–	
t_{ON} ($t_d + t_r$) $V_{CC} = -30$ V $R_L = 5\ \Omega$ $I_{B1} = I_{B2} = -0.6$ A		-6	0.3 (typ.)		0.3 (typ.)		0.3 (typ.)		0.3 (typ.)		µs
t_{OFF} ($t_s + t_f$) $V_{CC} = -30$ V $R_L = 5\ \Omega$ $I_{B1} = I_{B2} = -0.6$ A		-6	0.7 (typ.)		0.7 (typ.)		0.7 (typ.)		0.7 (typ.)		
$R_{\theta JC}$			–	1.92	–	1.92	–	1.92	–	1.92	°C/W
$R_{\theta JA}$			–	62.5	–	62.5	–	62.5	–	62.5	

[a] Pulsed, pulse duration = 300 µs, duty factor ⩽ 2%.

[b] *CAUTION:* Sustaining voltage, V_{CEO}(sus), *MUST NOT* be measured on a curve tracer.

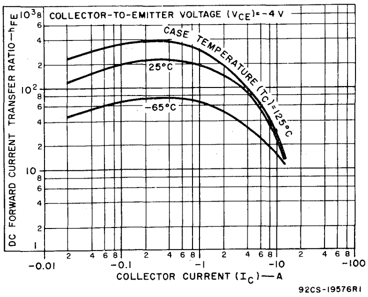


Fig. 4 — Typical dc beta characteristics for TIP42, TIP42A, and TIP42B.

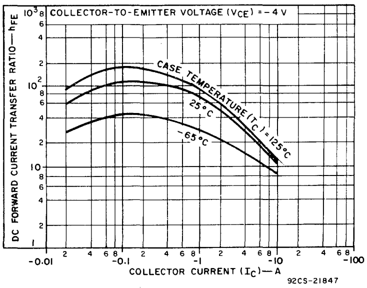


Fig. 5 — Typical dc beta characteristics for TIP42C.

TIP47, TIP48, TIP49, TIP50

High-Voltage Silicon N-P-N VERSAWATT Transistors

For High-Speed Switching and Linear-Amplifier Applications

The RCA-TIP47, TIP48, TIP49, and TIP50 are silicon n-p-n transistors with pi-nu construction. Typical applications for these transistors include high-voltage switches and switching regulators. TV horizontal-deflection circuits, power supplies, and TV audio-output circuits. They are supplied in the JEDEC TO-220AB straight-lead version of the VERSAWATT package, and can be provided in formed-lead configurations upon request.

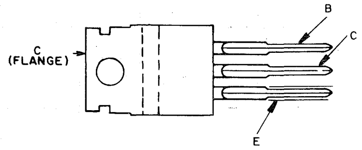
Features:

- **Rugged clip-type pellet attachment**
- **Glass passivated chip**
- **VERSAWATT package (molded silicone plastic)**
- **Thermal-cycling ratings**
- **Maximum safe-area-of-operation curves**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

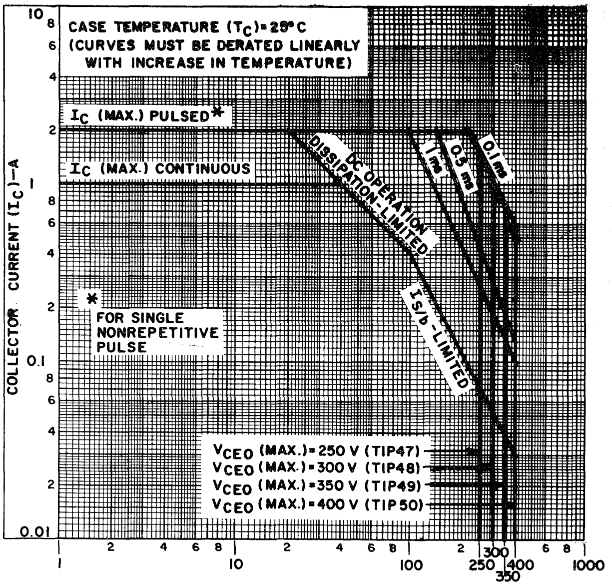
	TIP47	TIP48	TIP49	TIP50	
V_{CBO}	350	400	450	500	V
$V_{CEO}(sus)$	250	300	350	400	V
V_{EBO}	5	5	5	5	V
I_C	1	1	1	1	A
I_{CM}	2	2	2	2	A
I_B	0.6	0.6	0.6	0.6	A
P_T:					
T_C up to 25°C	40	40	40	40	W
T_C above 25°C. Derate linearly	0.32				W/°C
T_A up to 25°C	1.8				W
T_{stg}, T_J	−65 to 150				°C
T_L:					
At distance ⩾ 1/8 in. (3.17 mm) from seating plane for 10 s max.	235				°C

TERMINAL DESIGNATIONS



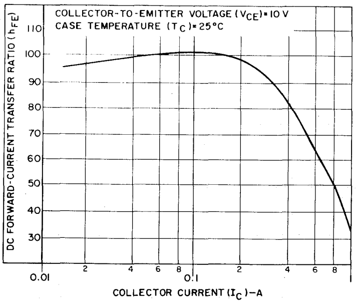
92CS-27519

JEDEC TO-220AB



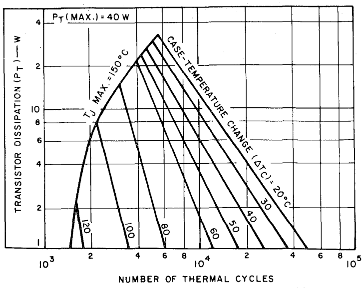
92CS-28656

Fig.1 — Maximum operating areas for all types.



92CS-28657

Fig.2 — Typical dc beta characteristics for all types.



92CS-18003R1

Fig.3 — Thermal-cycling rating chart for all types.

TIP47, TIP48, TIP49, TIP50

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

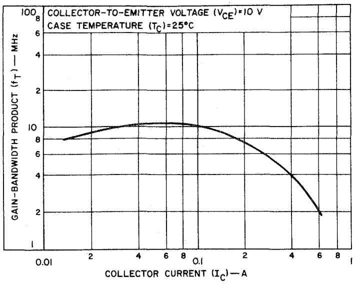
CHARACTERISTIC	TEST COND.		LIMITS								UNITS
	VOLTAGE V dc	CURRENT A dc	TIP47		TIP48		TIP49		TIP50		
	V_{CE}	I_C	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
I_{CEO} $I_B = 0$ $R_{BE} = 1000\ \Omega$	150		–	1	–	–	–	–	–	–	mA
	200		–	–	–	1	–	–	–	–	
	250		–	–	–	–	–	1	–	–	
	300		–	–	–	–	–	–	–	1	
I_{CES} $V_{EB} = 0$	350		–	1	–	–	–	–	–	–	mA
	400		–	–	–	1	–	–	–	–	
	450		–	–	–	–	–	1	–	–	
	500		–	–	–	–	–	–	–	1	
I_{EBO} $V_{BE} = -5$ V		0	–	1	–	1	–	1	–	1	mA
h_{FE}	10 10	1[a] 0.03[a]	10 30	– 150	10 30	– 150	10 30	– 150	10 30	– 150	
$V_{CEO}(sus)$ $I_B = 0$		0.3[a]	250[b]	–	300[b]	–	350[b]	–	400[b]	–	V
V_{BE}	10	1[a]	–	1.5	–	1.5	–	1.5	–	1.5	V
$V_{CE}(sat)$ $I_B = 0.2$ A		1[a]	–	1	–	1	–	1	–	1	V
$\lvert h_{fe} \rvert$ f = 1 MHz	10	0.2	5	–	5	–	5	–	5	–	
f_T f = 1 MHz	10	0.2	5	–	5	–	5	–	5	–	MHz
h_{fe} f = 1 kHz	10	0.2	25	–	25	–	25	–	25	–	
$I_{S/b}$ t = 0.5 s	100	–	0.4	–	0.4	–	0.4	–	0.4	–	A
t_{ON} $(t_d + t_r)$[c,d] $V_{CC} = 200$ V		1	0.2 (typ.)		0.2 (typ.)		0.2 (typ.)		0.2 (typ.)		μs
t_s[c,d] $V_{CC} = 200$ V		1	2 (typ.)		2 (typ.)		2 (typ.)		2 (typ.)		
t_f[c,d] $V_{CC} = 200$ V		1	0.5 (typ.)		0.5 (typ.)		0.5 (typ.)		0.5 (typ.)		
$R_{\theta JC}$			–	3.12	–	3.12	–	3.12	–	3.12	°C/W
$R_{\theta JA}$			–	70	–	70	–	70	–	70	

[a] Pulsed, pulse duration = 300 μs, duty factor ⩽ 2%..

[b] *CAUTION: Sustaining voltage, $V_{CEO}(sus)$, MUST NOT be measured on a curve tracer.*

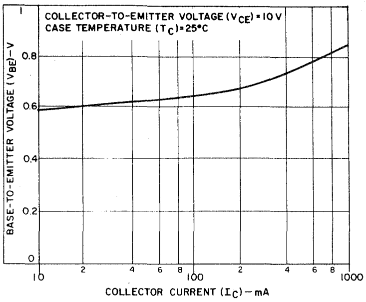
[c] See Fig. 9.

[d] $I_{B1} = I_{B2} = 0.1$ A.



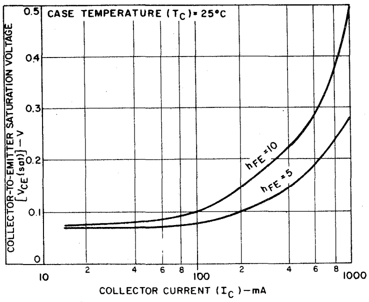
92CS-24128

Fig.4 – Typical gain-bandwidth characteristics for all types.



92CS-28658

Fig.5 – Typical base-to-emitter voltage vs. collector current.



92CS-28659

Fig.6 – Typical saturation-voltage characteristics for all types.

TIP120, TIP121, TIP122

8-Ampere N-P-N Darlington Power Transistors

60, 80, and 100 Volts, 65 Watts
Gain of 500 at 0.5 A
Gain of 1000 at 3 A

The RCA-TIP120, TIP121 and TIP122 are monolithic n-p-n silicon Darlington transistors designed for low- and medium-frequency power applications. The double epitaxial construction of these devices provides good forward and reverse second-breakdown capability; their high gain makes it possible for them to be driven directly from integrated circuits.

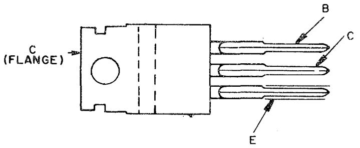
These devices are supplied in the JEDEC TO-220AB straight-lead version of the VERSAWATT package. Optional lead configurations are available upon request. For information, contact your nearest RCA Sales Office.

The TIP120, TIP121 and TIP122 are n-p-n complements of the TIP125, TIP126 and TIP127.

Features:
- Operates from IC without predriver
- Low leakage at high temperature
- High reverse second-breakdown capability

Applications:
- Power switching
- Audio amplifiers
- Hammer drivers
- Series and shunt regulators

TERMINAL DESIGNATIONS

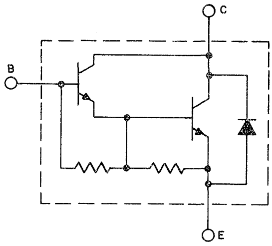


92CS-27519

JEDEC TO-220AB

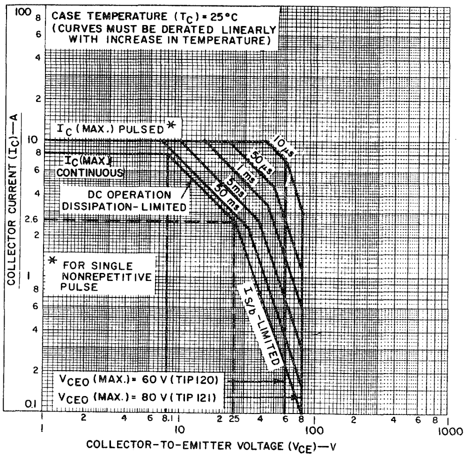
MAXIMUM RATINGS, *Absolute-Maximum Values:*

	TIP120	TIP121	TIP122	
V_{CBO}	60	80	100	V
V_{CER}(sus)				
R_{BE} = 100 Ω	60	80	100	V
V_{CEO}(sus)	60	80	100	V
V_{CEV}(sus)				
V_{BE} = −1.5 V	60	80	100	V
V_{EBO}	5	5	5	V
I_C	8	8	8	A
I_{CM}	10	10	10	A
I_B	0.25	0.25	0.25	A
P_T:				
T_C up to 25°C	65	65	65	W
T_C above 25°C . . . . Derate linearly at		0.52		W/°C
T_{stg}, T_J		−65 to 150		°C
T_L				
At distance ⩾ 1/8 in. (3.17 mm) from case for 10 s max.		235		°C



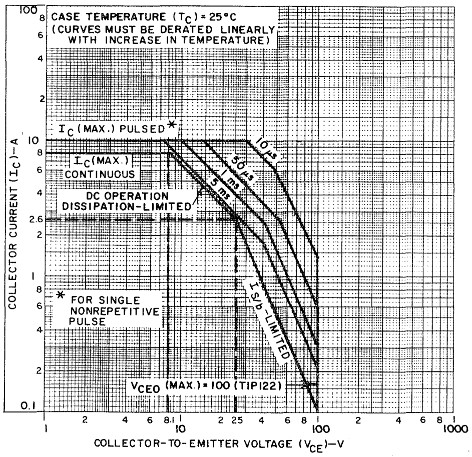
92CS-20691R2

Fig. 1 – Schematic diagram for all types.



92CS-28977

Fig. 2 – Maximum operating areas for TIP120 and TIP121.



92CS-28978

Fig. 3 – Maximum operating areas for TIP122.

TIP120, TIP121, TIP122

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C*

CHARACTERISTIC	TEST CONDITIONS				LIMITS						UNITS
	Voltage V dc		Current A dc		TIP120		TIP121		TIP122		
	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
I_{CBO} I_E=0	60 80 100				– – –	0.2 – –	– – –	– 0.2 –	– – –	– – 0.2	mA
I_{CEO}	30 40 50			0 0 0	– – –	0.5 – –	– – –	– 0.5 –	– – –	– – 0.5	
I_{EBO}		–5	0		–	3	–	3	–	3	mA
V_{CEO}(sus)			0.2[a]	0	60	–	80	–	100	–	V
h_{FE}	3 3		3[a] 0.5[a]		1000 500	– –	1000 500	– –	1000 500	– –	
V_{BE}	3		3[a]		–	2.5	–	2.5	–	2.5	V
V_{CE}(sat)			3[a] 5[a]	0.012 0.02	– –	2 3	– –	2 3	– –	2 3	V
h_{fe} f=1 kHz	5		1		1000	–	1000	–	1000	–	
$\|h_{fe}\|$ f=1 MHz	5		1		20	–	20	–	20	–	
C_{obo} V_{CB}=10 V f=1 MHz					–	200	–	200	–	200	pF
$E_{S/b}$ L=12 mH, R_{BE}=100 Ω		–1.5	4.5		120	–	120	–	120	–	mJ
$I_{S/b}$ t=0.5 s non-rep. pulse	25				2.6	–	2.6	–	2.6	–	A
$R_{\theta JC}$					–	1.92	–	1.92	–	1.92	°C/W

[a] Pulsed, pulse duration = 300 μs, duty factor ⩽ 2%.

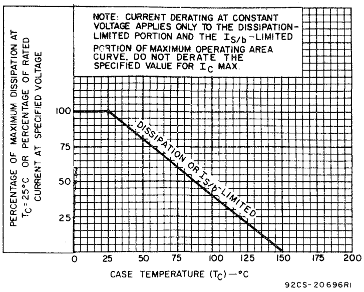


Fig. 4 — Derating curve for all types.

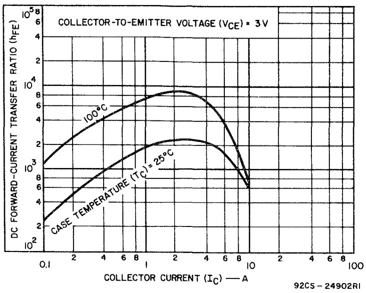


Fig. 5 — Typical dc beta characteristics for all types.

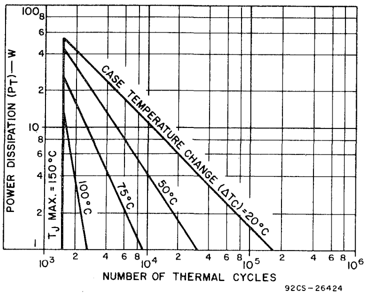


Fig. 6 — Thermal-cycling rating chart for all types.

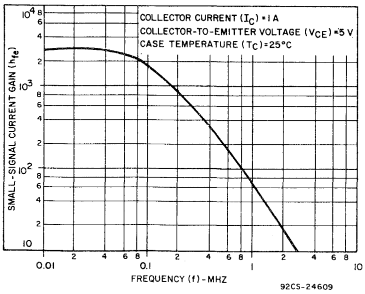


Fig. 7 — Typical small-signal current gain for all types.

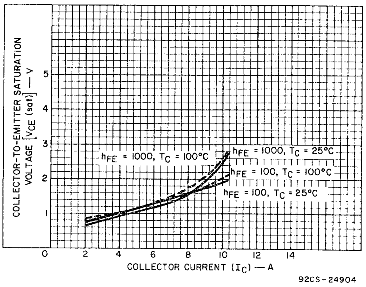


Fig. 8 — Typical saturation characteristics for all types.

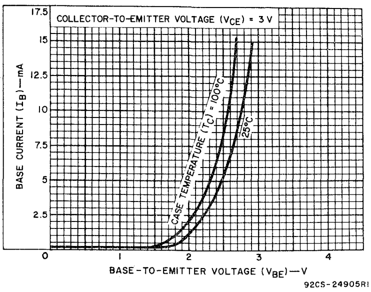


Fig. 9 — Typical input characteristics for all types.

TIP120, TIP121, TIP122

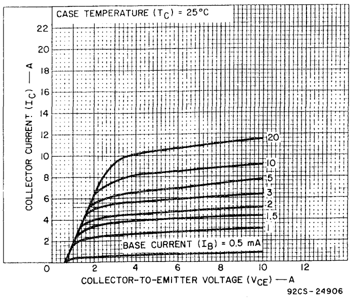


Fig. 10 – Typical output characteristics for all types.

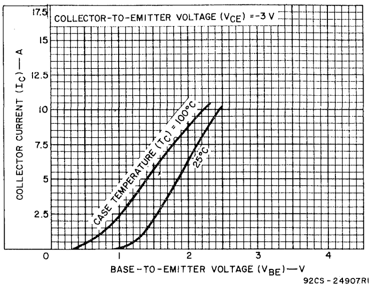


Fig. 11 – Typical transfer characteristics for all types.

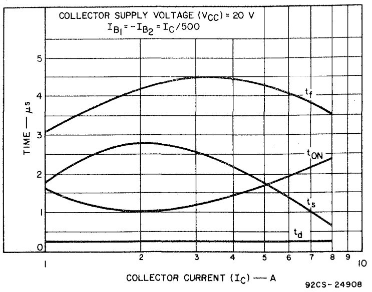


Fig. 12 – Typical saturated switching characteristics for all types.

TIP125, TIP126, TIP127

8-Ampere P-N-P Darlington Power Transistors

−60, −80, and −100 Volts, 65 Watts
Gain of 1000 at −3 A
Gain of 500 at −0.75 A

The RCA-TIP125, TIP126 and TIP127 are monolithic silicon p-n-p Darlington transistors designed for low- and medium-frequency power applications. The high gain of these devices makes it possible for them to be driven directly from integrated circuits.

These devices are supplied in the JEDEC TO-220AB straight-lead version of the VERSAWATT package. Optional lead configurations are available upon request. For information, contact your nearest RCA Sales Office.

The TIP125, TIP126 and TIP127 are p-n-p complements of the TIP120, TIP121 and TIP122.

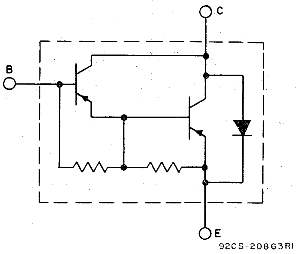
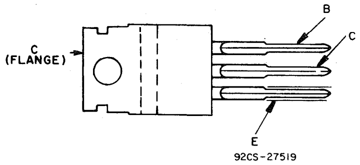


Fig. 1 – Schematic diagram for all types.

Features:
- **Operates from IC without predriver**
- **Low leakage at high temperature**
- **High reverse second-breakdown capability**

Applications:
- **Power switching**
- **Audio amplifiers**
- **Hammer drivers**
- **Series and shunt regulators**

TERMINAL DESIGNATIONS



JEDEC TO-220AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	TIP125	TIP126	TIP127	
V_{CBO}	−60	−80	−100	V
$V_{CEO}(sus)$	−60	−80	−100	V
V_{EBO}	−5	−5	−5	V
I_C	−8	−8	−8	A
I_{CM}	−15	−15	−15	A
I_B	−0.25	−0.25	−0.25	A
P_T:				
$T_C \leqslant 25^\circ C$	65	65	65	W
$T_C > 25^\circ C$ . . . Derate linearly at	0.52			W/°C
T_{stg}, T_J	−65 to 150			°C
T_L				
At distance 1/8 in. (3.17 mm) from case for 10 s max.	235			°C

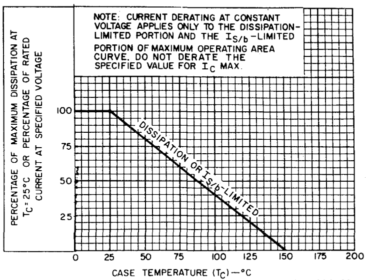


Fig. 3 – Dissipation derating curve for all types.

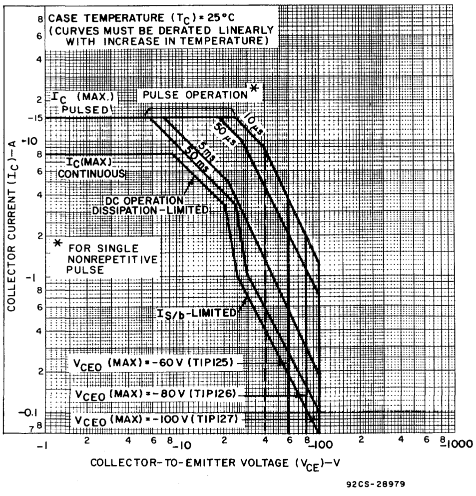


Fig. 2 – Maximum operating areas for all types.

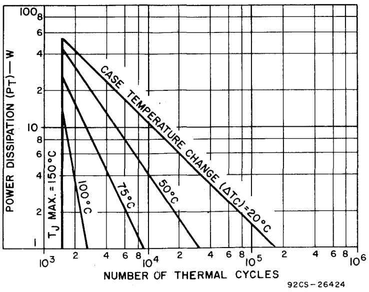


Fig. 4 – Thermal-cycling rating chart for all types.

TIP125, TIP126, TIP127

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C*

CHARAC-TERISTIC	TEST CONDITIONS			LIMITS						UNITS
	Voltage V dc	Current A dc		TIP125		TIP126		TIP127		
	V_{CE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
I_{CEO}	−30 −40 −50		0 0 0	– – –	−0.5 – –	– – –	– −0.5 –	– – –	– – −0.5	mA
I_{EBO} V_{BE}=5 V		0		–	−10	–	−10	–	−10	mA
V_{CEO}(sus)		-0.03^a	0	−60	–	−80	–	−100	–	V
h_{FE}	−3 −3	-0.75^a -3^a		500 1000	– –	500 1000	– –	500 1000	– –	
V_{BE}	−3	-3^a		–	−2.5	–	−2.5	–	−2.5	V
V_{CE}(sat)		-3^a -5^a	−0.012 −0.02	– –	−2 −4	– –	−2 −4	– –	−2 −4	V
h_{fe} f=1 kHz	−5	−1		1000	–	1000	–	1000	–	
$\|h_{fe}\|$ f=1 MHz	−5	−1		20	–	20	–	20	–	
$I_{S/b}$ t=1-s nonrep. pulse	−20			−3.2	–	−3.2	–	−3.2	–	A
$R_{\theta JC}$				–	1.92	–	1.92	–	1.92	°C/W

[a] Pulsed: Pulse duration = 300 μs, duty factor ⩽ 2%.

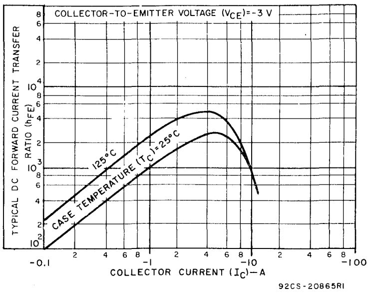


Fig. 5 — Typical dc beta characteristics for all types.

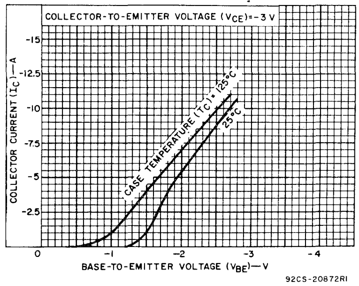


Fig. 6 — Typical transfer characteristics for all types.

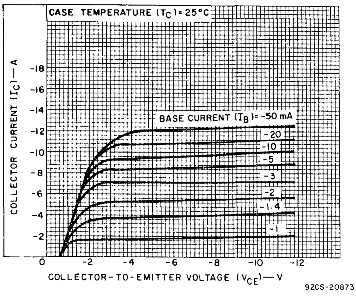


Fig. 7 — Typical output characteristics for all types.

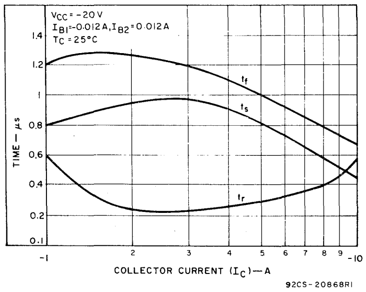


Fig. 8 — Typical saturated switching-time characteristics for all types.

RCA Equivalents of Popular Industry Types

Hometaxial-Base VERSAWATT Types (JEDEC TO-220AB Plastic Package)

Type No.	Polarity	I_C (A)	P_T (W)	$V_{CEO}(sus)$ (V)	h_{FE}/@ I_C (A)	f_T (MHz)	Complementary Type	Data File No.
RCA29/SDH	n-p-n	4	36	40	40 min./0.2	0.8	–	792
RCA29A/SDH	n-p-n	4	36	60	40 min./0.2	0.8	–	792
RCA29B/SDH	n-p-n	4	36	80	40 min./0.2	0.8	–	792
RCA29C/SDH	n-p-n	2.5	50	100	40 min./0.2	0.8	–	792
RCA31/SDH	n-p-n	4	36	40	25 min./1	0.8	–	793
RCA31A/SDH	n-p-n	4	36	60	25 min./1	0.8	–	793
RCA31B/SDH	n-p-n	4	36	80	25 min./1	0.8	–	793
RCA31C/SDH	n-p-n	2.5	50	100	25 min./1	0.8	–	793
RCA41/SDH	n-p-n	16	75	40	30 min./0.3	0.8	–	794
RCA41A/SDH	n-p-n	10	75	60	30 min./0.3	0.8	–	794
RCA41B/SDH	n-p-n	10	75	80	30 min./0.3	0.8	–	794

Epitaxial-Base VERSAWATT Types (JEDEC TO-220AB Plastic Package)

RCA29	n-p-n	3	30	40	15-150/1	3	RCA30	583
RCA29A	n-p-n	3	30	60	15-150/1	3	RCA30A	583
RCA29B	n-p-n	3	30	80	15-150/1	3	RCA30B	583
RCA29C	n-p-n	3	30	100	15-150/1	3	RCA30C	583
RCA30	p-n-p	−3	30	−40	15-150/−1	3	RCA29	584
RCA30A	p-n-p	−3	30	−60	15-150/−1	3	RCA29A	584
RCA30B	p-n-p	−3	30	−80	15-150/−1	3	RCA29B	584
RCA30C	p-n-p	−3	30	−100	15-150/−1	3	RCA29C	584
RCA31	n-p-n	5	40	40	10-50/3	3	RCA32	585
RCA31A	n-p-n	5	40	60	10-50/3	3	RCA32A	585
RCA31B	n-p-n	5	40	80	10-50/3	3	RCA32B	585
RCA31C	n-p-n	5	40	100	10-50/3	3	RCA32C	585
RCA32	p-n-p	−5	40	−40	10-50/−3	3	RCA31	586
RCA32A	p-n-p	−5	40	−60	10-50/−3	3	RCA31A	586
RCA32B	p-n-p	−5	40	−80	10-50/−3	3	RCA31B	586
RCA32C	p-n-p	−5	40	−100	10-50/−3	3	RCA31C	586
RCA41	n-p-n	7	65	40	15-150/3	3	RCA42	587
RCA41A	n-p-n	7	65	60	15-150/3	3	RCA42A	587
RCA41B	n-p-n	7	65	80	15-150/3	3	RCA42B	587
RCA41C	n-p-n	7	65	100	15-150/3	3	RCA42C	587
RCA42	p-n-p	−7	65	−40	15-150/−3	3	RCA41	588
RCA42A	p-n-p	−7	65	−60	15-150/−3	3	RCA41A	588
RCA42B	p-n-p	−7	65	−80	15-150/−3	3	RCA41B	588
RCA42C	p-n-p	−7	65	−100	15-150/−3	3	RCA41C	588

Epitaxial-Base Hermetic Types (JEDEC TO-66 Package)

RCS29	n-p-n	3	30	40	15-150/1	3	RCS30	880
RCS29A	n-p-n	3	30	60	15-150/1	3	RCS30A	880
RCS29B	n-p-n	3	30	80	15-150/1	3	RCS30B	880
RCS29C	n-p-n	3	30	100	15-150/1	3	RCS30C	880
RCS30	p-n-p	−3	30	−40	15-150/−1	3	RCS29	881
RCS30A	p-n-p	−3	30	−60	15-150/−1	3	RCS29A	881
RCS30B	p-n-p	−3	30	−80	15-150/−1	3	RCS29B	881
RCS30C	p-n-p	−3	30	−100	15-150/−1	3	RCS29C	881
RCS31	n-p-n	5	40	40	10-50/3	3	RCS32	882
RCS31A	n-p-n	5	40	60	10-50/3	3	RCS32A	882
RCS31B	n-p-n	5	40	80	10-50/3	3	RCS32B	882
RCS31C	n-p-n	5	40	100	10-50/3	3	RCS32C	882
RCS32	p-n-p	−5	40	−40	10-50/−3	3	RCS31	883
RCS32A	p-n-p	−5	40	−60	10-50/−3	3	RCS31A	883
RCS32B	p-n-p	−5	40	−80	10-50/−3	3	RCS31B	883
RCS32C	p-n-p	−5	40	−100	10-50/−3	3	RCS31C	883

High-Voltage Hermetic Types (JEDEC TO-3 Package)

RCA410	n-p-n	7	125	200	30-90/1	4	–	509
RCA411	n-p-n	7	125	300	30-90/1	2.5	–	510
RCA413	n-p-n	7	125	325	20-80/0.5	4	–	511
RCA423	n-p-n	7	125	325	30-90/1	4	–	512
RCA431	n-p-n	7	125	325	15-35/2.5	4	–	513

CH2102, CH2270, CH2405, CH3053, CH3439, CH3440, CH4036, CH4037, CH5320-CH5323, CH6479

Unmounted and Unencapsulated N-P-N and P-N-P Silicon Power Transistor Chips

Features:

- **Prepared and tested for use in hybrid circuits**
- **h_{FE} ratings from 30 to 50 (min.)**
- **I_{CBO} leakage ratings in the 10 µA to 1 mA range**
- **V_{CEO} ratings up to 90 V on planar transistor chips; up to 325 V on passivated mesa types**
- **I_C up to 12 A (CH6479)**

The transistor chip families described in this bulletin are selected from the broad line of RCA discrete power transistors. Known also as pellets or dies, these chips represent the essential electronic portion of the transistor. They are especially suited for direct mounting on a heat sink in hybrid circuits. The n-p-n and p-n-p types can be used either singly or in complementary-pair configurations for large-signal medium-power applications.

All of the chip families shown are double-diffused epitaxial types. Six of the families are of planar construction; the other is of a passivated mesa construction. The oxide layer that results from conventional planar processing protects the planar types. The junctions and surfaces of the mesa transistor chips are protected by deposited glass-passivated coverings.

Aluminum has been deposited at the base and emitter electrodes of all the transistor chips for ease of bonding. The base and emitter bonding areas on each chip will accommodate up to a 0.003-inch (0.076-mm)-diameter bond wire except for the CH6479 which will accommodate a 0.010-inch (0.254-mm) wire. Either thermo-compression or ultrasonic bonding can be used to attach gold wires to these electrodes; aluminum wires can also be bonded by conventional ultrasonic techniques.

The collector contact, which is on the underside of the chip, has been metallized with gold for all of the chips except CH6479. For all of the chips, the collector can be attached directly to a heat sink by adhesive or by gold-silicon or gold-germanium eutectic bonding methods.

The CH6479, because of its large size, must be mounted on a heat sink made of material with thermal expansion coefficient close to that of silicon; suitable materials are molybdenum or beryllium oxide. A special cleaning step is required in mounting the CH6479.

All of the chips must be mounted in an inert or reduced atmosphere. The chips must not be subjected to more than 400°C for a maximum of 1 minute. Because of the specially prepared surfaces of the chips (except as noted for the CH6479), etching of the pellets or the use of flux is not recommended.

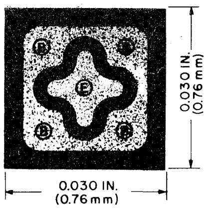
The chips are supplied in plastic containers. Each chip is securely held in a recessed partition of the container by a clear plastic cover that also protects the surface from dust and abrasion. For additional protection, the container is sealed in a clear plastic bag. If the sealed shipping container is opened or broken, ruptured, punctured, or damaged in any way, the chips must be stored at a temperature of not more than 40°C and a relative humidity of not more than 50% in a clean, dust-free environment. If the sealed shipping container is damaged on receipt as described above, the product should be immediately returned to RCA.

These unmounted and unencapsulated chips are tested electrically and visually inspected to meet the specifications shown on the following pages. Written notification of non-conformance to such specifications must be made to RCA within 90 days of the date of the shipment by RCA. RCA assumes no responsibility for chips which have been subjected to further processing, such as, but not limited to, lead-bonding or pellet-mounting operations.

RCA has the right to change the chip design and processing without notification.

Assistance in determining proper mounting and bonding procedures is available from RCA.

2N2102 Family (n-p-n)



Ⓑ 4 Base Bonding Areas 0.008 in. (0.20 mm) diameter

Ⓔ Emitter Bonding Area 0.008 in. (0.20 mm) diameter

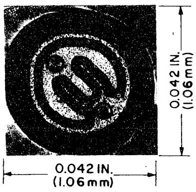
CH2102 CH2270 CH2405 CH3053

RCA-CH2102, CH2270, CH2405, and CH3053 are double-diffused n-p-n epitaxial planar transistor chips similar to RCA-2N2102, 2N2270, 2N2405. and 2N3053 transistors, respectively. They can be used either singly or in complementary-pair configurations with RCA p-n-p chips CH4036 and CH4037 for large-signal medium-power applications.

ELECTRICAL CHARACTERISTICS, at Chip Temperature = 25°C

Characteristic	Symbol	Test Conditions				Limits								Units
		Voltage V dc		Current mA dc		CH2102		CH2270		CH2405		CH3053		
		V_{CB}	V_{CE}	I_C	I_E	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Collector Cutoff Current	I_{CBO}	60					10		10		10		10	µA
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$				0.01	5		5		5		5		V
Collector-to-Emitter Sustaining Voltage: Base open[a]	$V_{CEO(sus)}$			20		60		45		90		30		V
DC Forward-Current Transfer Ratio[b]	h_{FE}		10	150		50		50		50		50		

2N3439 Family (n-p-n)



Ⓑ Base Bonding Area 0.005 in. (0.13 mm) diameter

Ⓔ Emitter Bonding Area 0.005 in. (0.13 mm) diameter

CH3439 CH3440

RCA-CH3439 and CH3440 are passivated mesa n-p-n transistor chips similar to those used in RCA-2N3439 and 2N3440 high-voltage transistors. Because of their high breakdown voltages, good high-frequency response, and fast switching speeds, these transistor chips can be used in high-voltage differential and operational amplifiers, high-voltage inverters and high-voltage, low-current switching regulators.

ELECTRICAL CHARACTERISTICS, at Chip Temperature = 25°C

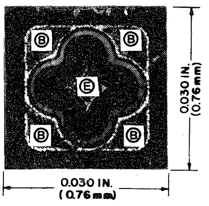
Characteristic	Symbol	Test Conditions				Limits				Units
		Voltage V dc		Current mA dc		CH3439		CH3440		
		V_{CB}	V_{CE}	I_C	I_E	Min.	Max.	Min.	Max.	
Collector Cutoff Current	I_{CBO}	200					20		50	µA
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$				0.02	5		5		V
Collector-to-Emitter Sustaining Voltage: Base open[a]	$V_{CEO(sus)}$			20		325		250		V
DC Forward-Current Transfer Ratio[b]	h_{FE}		10	20		30		30		

[a] CAUTION: This voltage MUST NOT be measured on a curve tracer. [b] Pulse tested; 2% duty factor, less than or equal to 300 µs duration.

CH2102, CH2270, CH2405, CH3053, CH3439, CH3440, CH4036, CH4037, CH5320-CH5323, CH6479

Unmounted and Unencapsulated N-P-N and P-N-P Silicon Power Transistor Chips (Cont'd)

2N4036 Family (p-n-p)



Ⓑ 4 Base Bonding Areas 0.008 in. (0.20 mm) diameter

Ⓔ Emitter Bonding Area 0.008 in. (0.20 mm) diameter

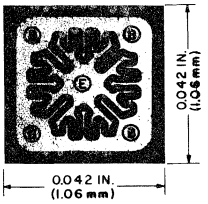
CH4036 CH4037

RCA-CH4036 and CH4037 are double-diffused p-n-p epitaxial planar transistor chips similar to RCA-2N4036 and 2N4037 transistors. Their high-voltage ratings and heat-dissipating ability make them ideal for amplifying large signals at a medium power level. They can be used singly or as complements of RCA n-p-n chips CH2102, CH2270, CH2405, and CH3053.

ELECTRICAL CHARACTERISTICS, at Chip Temperature = 25°C

Characteristic	Symbol	Test Conditions				Limits				Units
		Voltage V dc		Current mA dc		CH4036		CH4037		
		V_{CB}	V_{CE}	I_C	I_E	Min.	Max.	Min.	Max.	
Collector Cutoff Current	I_{CBO}	-60					-10		-10	μA
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$				-0.01	-6.5		-6.6		V
Collector-to-Emitter Sustaining Voltage: Base open [a]	$V_{CEO(sus)}$			-20		-65		-40		V
DC Forward-Current Transfer Ratio [b]	h_{FE}		-10	-150		35		35		

2N5320 Family (n-p-n)



Ⓑ 4 Base Bonding Areas 0.008 in. (0.20 mm) diameter

Ⓔ Emitter Bonding Area 0.008 in. (0.20 mm) diameter

CH5320 CH5321

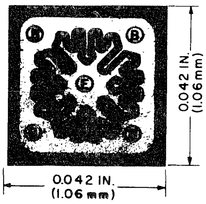
RCA-CH5320 and CH5321 are double-diffused n-p-n epitaxial planar transistor chips similar to RCA-2N5320 and 2N5321 transistors. They can be used singly or as complements of RCA p-n-p chips CH5322 and CH5323.

ELECTRICAL CHARACTERISTICS, at Chip Temperature = 25°C

Characteristic	Symbol	Test Conditions				Limits				Units
		Voltage V dc		Current mA dc		CH5320		CH5321		
		V_{CB}	V_{CE}	I_C	I_E	Min.	Max.	Min.	Max.	
Collector Cutoff Current	I_{CBO}	60					10		10	μA
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$				0.01	5		5		V
Collector-to-Emitter Sustaining Voltage: Base open [a]	$V_{CEO(sus)}$			20		80		55		V
DC Forward-Current Transfer Ratio [b]	h_{FE}		10	250		30		30		

[a] CAUTION: This voltage MUST NOT be measured on a curve tracer. [b] Pulse tested; 2% duty factor, less than or equal to 300 μs duration.

2N5323 Family (p-n-p)



Ⓑ 4 Base Bonding Areas 0.008 in. (0.20 mm) diameter

Ⓔ Emitter Bonding Area 0.008 in. (0.20 mm) diameter

CH5322 CH5323

RCA-CH5322 and CH5323 are double-diffused p-n-p epitaxial planar transistor chips similar to RCA-2N5322 and 2N5323 transistors. They can be used singly or as complements of RCA n-p-n chips CH5320 and CH5321 for amplifying large signals at a medium power level.

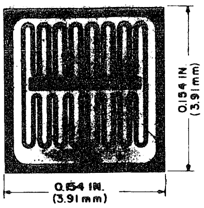
ELECTRICAL CHARACTERISTICS, at Chip Temperature = 25°C

Characteristic	Symbol	Test Conditions				Limits				Units
		Voltage V dc		Current mA dc		CH5322		CH5323		
		V_{CB}	V_{CE}	I_C	I_E	Min.	Max.	Min.	Max.	
Collector Cutoff Current	I_{CBO}	-60					-10		-10	μA
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$				-0.01	-5		-5		V
Collector-to-Emitter Sustaining Voltage: Base open [a]	$V_{CEO(sus)}$			-20		-80		-55		V
DC Forward-Current Transfer Ratio [b]	h_{FE}		-10	-250		30		30		

CH2102, CH2270, CH2405, CH3053, CH3439, CH3440, CH4036, CH4037, CH5320-CH5323, CH6479

Unmounted and Unencapsulated N-P-N and P-N-P Silicon Power Transistor Chips (Cont'd)

2N6479 Family (n-p-n)



Ⓑ Base Bonding Area 0.013 in. (0.33 mm) x 0.091 in. (2.31 mm)

Ⓔ Emitter Bonding Area 0.013 in. (0.33 mm) x 0.091 in. (2.31 mm)

CH6479

RCA-CH6479 is a double-diffused n-p-n epitaxial planar transistor chip similar to the RCA-2N6479 transistor. Radiation hardening makes this type suitable for aerospace applications, and high-switching speeds make it ideal for use in high-speed inverters, switching regulators, and military hybrid applications.

ELECTRICAL CHARACTERISTICS, at Chip Temperature = 25°C

Characteristic	Symbol	Test Conditions				Limits		Units
		Voltage V dc		Current mA dc		CH6479		
		V_{CB}	V_{CE}	I_C	I_E	Min.	Max.	
Collector Cutoff Current	I_{CBO}	100					1	mA
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$				1	5		V
Collector-to-Emitter Sustaining Voltage: Base open [a]	$V_{CEO(sus)}$			25		60		V
DC Forward-Current Transfer Ratio [b]	h_{FE}		2	500		40		

CH6479 Chip Special Clean-Up Schedule:

Before eutectic mounting, the CH6479 chip must be etched for 30 seconds in a 10% (by volume) electronic-grade hydrofluoric acid solution at 25°C ± 5°C with agitation. Normal precautions for using hydrofluoric acid should be observed. The chip must then be dried and mounted within 8 hours.

CHIP INSPECTION INFORMATION

Each lot is inspected to a 2.5% AQL (cumulative) according to Mil Std. 105 using 20 times magnification. The following defects determine the inspection criteria:

Foreign matter adhering to the base and emitter bond areas.

Improperly cut pellets that include a portion of another pellet.

Bridging by the metallization which causes a short.

Blistering, lifting or absence of the aluminum metallization.

Fractures or edges within 0.0005 in. (0.013) mm of the base collector junction.

Severed base-contact rings that isolate all the bonding pads and most of the base area.

Oxide missing from the junction area.

RF Power Transistors
Technical Data

2N918 2N3600

SILICON N-P-N EPITAXIAL PLANAR TRANSISTORS

For VHF Applications in Military, Communications, and Industrial Equipment

MAXIMUM RATINGS, Absolute-Maximum Values:

	2N918	2N3600	
COLLECTOR-TO-BASE VOLTAGE, V_{CBO}	30	30 max.	V
COLLECTOR-TO-EMITTER VOLTAGE, V_{CEO}	15	15 max.	V
EMITTER-TO-BASE VOLTAGE, V_{EBO}	3	3 max.	V
COLLECTOR CURRENT, I_C	50	* max.	mA
TRANSISTOR DISSIPATION, P_T: For operation with heat sink: At case temperatures** up to 25°C	300	300 max.	mW
above 25°C	Derate at 1.71 mW/°C		

* Limited by transistor dissipation.

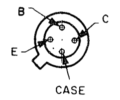
** Measured at center of seating surface.

	2N918	2N3600	
For operation at ambient temperatures: At ambient temperatures up to 25°C	200	200 max.	mW
above 25°C	Derate at 1.14 mW/°C		
TEMPERATURE RANGE: Storage and Operating (Junction)	-65 to +200		°C
LEAD TEMPERATURE (During Soldering): At distances ≥ 1/16 inch from seating surface for 60 seconds max.	300	300 max.	°C

Features:
- high gain-bandwidth product
- hermetically sealed four-lead package
- low leakage current
- high 200-MHz power gain

2N3600
- low noise figure
  NF = 4.5 dB max. at 200 MHz
- low collector-to-base time constant
  $r_b'C_c$ = 15 ps max.
- high power gain as neutralized amplifier
  G_{pe} = 17 dB min. at 200 MHz

TERMINAL DESIGNATIONS



JEDEC TO-72

92CS-27513

ELECTRICAL CHARACTERISTICS

Characteristics	Symbols	TEST CONDITIONS								LIMITS						Units
		Ambient Temperature T_A	Frequency f	DC Collector-to-Base Voltage V_{CB}	DC Collector-to-Emitter Voltage V_{CE}	DC Emitter-to-Base Voltage V_{EB}	DC Emitter Current I_E	DC Collector Current I_C	DC Base Current I_B	Type 2N918			Type 2N3600			
		°C	MHz	V	V	V	mA	mA	mA	Min.	Typ.	Max.	Min.	Typ.	Max.	
Collector-Cutoff Current	I_{CBO}	25 150		15 15			0 0			- -	- -	0.01 1	- -	- -	0.01 1	μA μA
Collector-to-Base Breakdown Voltage	BV_{CBO}	25					0	0.001		30	-	-	30	-	-	V
Collector-to-Emitter Sustaining Voltage	$BV_{CEO}(sus)$	25						3	0	15	-	-	15	-	-	V
Emitter-to-Base Breakdown Voltage	BV_{EBO}	25					0.01	0		3	-	-	3	-	-	V
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$	25						10	1	-	-	0.4	-	-	0.4	V
Base-to-Emitter Saturation Voltage	$V_{BE}(sat)$	25						10	1	-	-	1	-	-	1	V
Static Forward Current-Transfer Ratio	h_{FE}	25			1			3		20	-	-	20	-	150	
Small-Signal Forward Current-Transfer Ratio[a]	h_{fe}	25	100 100 1 kHz		10 6 6			4 5 2		6 - -	- - -	- - -	- 8.5 40	- - -	- 15 200	
Common-Base Output Capacitance[b]	C_{ob}	25	0.1 to 1	10 0			0 0			- -	- -	1.7 3	- -	- -	- -	pF pF
Collector-to-Base Feedback Capacitance[b]	C_{cb}	25	0.1 to 1	10			0			-	-	-	-	-	1	pF
Common-Base Input Capacitance[c]	C_{ib}	25	0.1 to 1			0.5		0		-	-	2	-	1.4	-	pF
Collector-to-Base Time Constant[a]	$r_b'C_c$	25	40 31.9	6 6				2 5		- -	15 -	- -	- 4	- -	- 15	ps ps
Small-Signal Power Gain in Neutralized Common-Emitter Amplifier Circuit[a]	G_{pe}	25	200		12 6			6 5		15 -	21 -	- -	- 17	- -	- 24	dB dB
Small-Signal Power Gain in Unneutralized Common-Emitter Amplifier Circuit[a]	G_{pe}	25	200		10			5		-	13	-	-	-	-	dB
Power Output in Common-Emitter Oscillator Circuit[c] (See Fig.5)	P_o	25	≥ 500	10			12			30	-	-	20	-	-	mW
Nose Figure[a]	NF	25	200		6			1.5		-	-	-	-	-	4.5	dB
Noise Figure[a,d]	NF	25	60		6			1		-	-	6	-	-	3	dB

[a] Lead No.4 (case) grounded.

[b] Three-terminal measurement of the collector-to-base capacitance with the case and emitter leads connected to the guard terminal.

[c] Lead No.4 (case) floating.

[d] Generator Resistance (R_g) = 400 ohms.

2N1491-2N1493

SILICON N-P-N PLANAR TRANSISTORS

VHF Amplifier & Oscillator Service

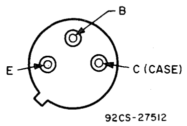
Features:

- **High V_{CB} Ratings – up to 100 V**
- **High Transistor -Dissipation Ratings – up to 3 watts**
- **High Typical f_T at I_C = 25 mA – up to 380 MHz**
- **High Typical Power Gain at 70 MHz – up to 12 db at 500-mW output**
- **JEDEC TO-39 Package**

Maximum Ratings, *Absolute-Maximum Values:*

		2N1491	2N1492	2N1493		
COLLECTOR-TO-BASE VOLTAGE . . .	V_{CBO}	30	60	100	max.	V
COLLECTOR-TO-EMITTER VOLTAGE:						
With emitter-to-base reverse biased. .	V_{CEV}	30	60	100	max.	V
EMITTER-TO-BASE VOLTAGE.	V_{EBO}	1	2	4.5	max.	V
COLLECTOR CURRENT	I_C	500	500	500	max.	mA
EMITTER CURRENT		500	500	500	max.	mA
TRANSISTOR DISSIPATION, See *Fig.3:*	P_T					
Operation in free air:						
Ambient temperature = 25° C . . .		0.5	0.5	0.5	max.	W
Ambient temperature = 100° C . . .		0.25	0.25	0.25	max.	W
Operation with heat sink:						
Case temperature = 25° C		3	3	3	max.	W
Case temperature = 100° C		1.5	1.5	1.5	max.	W
AMBIENT TEMPERATURE RANGE:						
Operating and storage			–65 to +175			°C

TERMINAL DESIGNATIONS



JEDEC TO-39

ELECTRICAL CHARACTERISTICS, *Ambient Temperature = 25° C*

Characteristics	Symbol	TEST CONDITIONS				LIMITS						Units
		DC Collector Voltage (volts)		DC Collector Current (mA)	DC Emitter Current (mA)	Type 2N1491		Type 2N1492		Type 2N1493		
		V_{CB}	V_{CE}			Min.	Max.	Min.	Max.	Min.	Max.	
Collector Breakdown Voltage	BV_{CBO}			0.1	0	30		60		100		volts
Collector Cutoff Current	I_{CBO}	12			0		10		10		10	µA
Emitter Cutoff Current	I_{EBO}		V_{EB} 0.5	0			100		100		100	µA
Collector-to-Base Capacitance	Cob	30			0		5		5		5	pF
Small-Signal Current Transfer Ratio: at 1 KHz	h_{fe}		20	15		15	200	15	200	15	200	
Power Gain at 70 MHz Power Output (mW) See *Fig.11* = 10 = 100 = 500	PG	20 30 50			–15 –15 –25	13		13		10		dB dB dB
Thermal Resistance Junction-to-case	R_T						50		50		50	°C/W

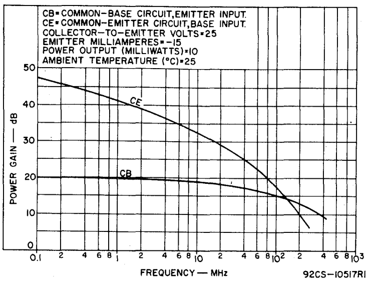


Fig. 1 - Performance characteristics.

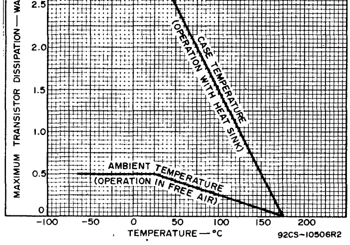


Fig. 2 - Dissipation derating graph.

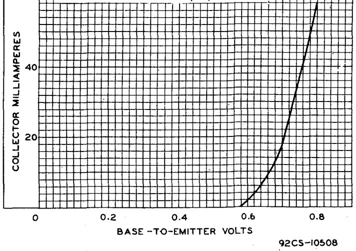


Fig. 3 - Typical characteristics.

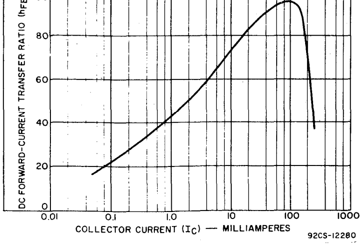


Fig. 4 - Typical dc beta characteristics.

2N2631, 2N2876

SILICON N-P-N PLANAR TRANSISTORS

For Large-Signal, High-Power, VHF Applications in Military and Industrial Communications Equipment

Features:

- High Power Output, Unneutralized (P_{OUT}):
  - 10 w min. at 50 Mc } 2N2876
  - 3 w min. at 150 Mc } 2N2876
  - 7.5 w min. at 50 Mc } 2N2631
  - 3 w min. at 150 Mc } 2N2631
- High Voltage Ratings:
  - V_{CBO} = 80 volts max.
  - V_{CEO} = 60 volts max.
- 100 per cent tested to assure freedom from second breakdown in class A operation at maximum ratings

Maximum Ratings, *Absolute-Maximum Values:*

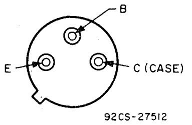
	2N2876	2N2631	
COLLECTOR-TO-BASE VOLTAGE, V_{CBO}	80	80	max. volts
COLLECTOR-TO-EMITTER VOLTAGE:			
With base open, V_{CEO}.	60	60	max. volts
With V_{BE} = -1.5 volts, V_{CEV}. . . .	80	80	max. volts
EMITTER-TO-BASE VOLTAGE, V_{EBO}. . . .	4	4	max. volts
COLLECTOR CURRENT, I_C.	2.5	1.5	max. amp
TRANSISTOR DISSIPATION, P_T:			
At case temperatures up to 25°C	17.5	8.75	max. watts
At case temperatures above 25°C	Derate linearly 100mw/°C	Derate linearly 50 mw/°C	

	2N2876	2N2631		
TEMPERATURE RANGE:				
Storage.	-65to+200	-65to+200		°C
Operating (Junction)	-65to+200	-65to+200		°C
LEAD TEMPERATURE (During soldering):				
At distances ≥ 1/32" from ceramic wafer for 10 sec. max. .	230	-	max.	°C
At distances ≥ 1/32" from seating surface for 10 sec. max. .	-	230	max	°C

RCA-2N2876 Features:

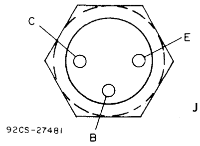
- Low Thermal Resistance (θ_{J-C})—
  high-thermal-conductivity ceramic insulation between collector and mounting stud
- Isolated Stud Package:
  - all three electrodes electrically isolated from case —for design flexibility
  - heavy copper mounting stud—for effective contact with heat sink
  - pin terminals arranged on a .200" pin-circle diameter —fit commercially available sockets

TERMINAL DESIGNATIONS



2N2631

JEDEC TO-39



2N2876

JEDEC TO-60

ELECTRICAL CHARACTERISTICS *Case Temperature = 25° C Unless Otherwise Specified*

Characteristic	Symbol	TEST CONDITIONS						LIMITS				Units
		DC Collector Volts		DC Base Volts	DC Current (Milliamperes)			2N2876		2N2631		
		V_{CB}	V_{CC}	V_{BE}	I_E	I_B	I_C	Min.	Max.	Min.	Max.	
Collector-Cutoff Current	I_{CBO}	30			0			-	0.1	-	0.1	μa
Collector-to-Base Breakdown Voltage	BV_{CBO}				0		0.5	80	-	80	-	volts
Collector-to-Emitter Breakdown Voltage (Sustaining)	$BV_{CEO}(sus)$					0	500*	60	-	60	-	volts
Collector-to-Emitter Breakdown Voltage	BV_{CEV}			-1.5			0.1	80	-	80	-	volts
Emitter-to-Base Breakdown Voltage	BV_{EBO}				0.1		0	4	-	4	-	volts
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$					300	1.5 amp	-	-	-	1	volt
						500	2.5 amp	-	1	-	-	volt
Feedback Capacitance (Measured at 140 Kc)	$C_{b'c}$	30			0			-	20	-	20	pf
RF Power Output, Unneutralized	P_{out}											
Measured at 50 Mc			28				500	10[a]	-	-	-	watts
50 Mc			28				375	-	-	7.5[b]	-	watts
150 Mc			28				275	3[b]	-	3[b]	-	watts
Gain-Bandwidth Product	f_T		28				250	200 (typ.)		200 (typ.)		Mc
Base Spreading Resistance (Measured at 400 Mc)	$r_{bb'}$		28				250	6.0 (typ.)		6.0 (typ.)		ohms
Collector-to-Case Capacitance	C_c							-	6	-	-	pf

* Pulsed. Pulse duration ≤ 5 μsec; duty factor ≤ 1%.

[a] For P_{IN} = 2 watts.

[b] For P_{IN} = 1 watt.

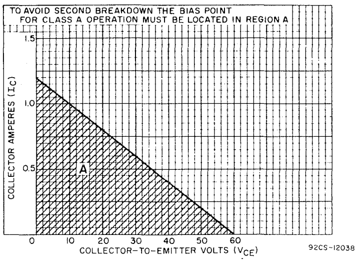


Fig. 1 - Region of safe operation (without second breakdown) in class A service for type 2N2876.

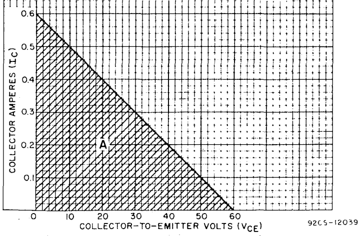


Fig. 2 - Region of safe operation (without second breakdown) in class A service for type 2N2631.

2N2857

SILICON N-P-N EPITAXIAL PLANAR TRANSISTOR

For UHF Applications in Industrial and Military Equipment

Features:

- high gain-bandwidth product— f_T = 1000 MHz min.
- high converter (450-to-30 MHz) gain— G_c = 15 dB typ. for circuit bandwidth of approximately 2 MHz
- high power gain as neutralized amplifier— G_{pe} = 12.5 dB min. at 450 MHz for circuit bandwidth of 20 MHz
- high power output as uhf oscillator—
  $P_o = \begin{cases} 30 \text{ mW min., } 40 \text{ mW typ. at } 500 \text{ MHz} \\ 20 \text{ mW typ., at } 1 \text{ GHz} \end{cases}$
- low device noise figure—
  $NF = \begin{cases} 4.5 \text{ dB max. as } 450 \text{ MHz amplifier} \\ 7.5 \text{ dB typ. as } 450\text{-to-}30 \text{ MHz converter} \end{cases}$
- low collector-to-base time constant— $r_b'C_c$ = 7 ps typ.
- low collector-to-base feedback capacitance— C_{cb} = 0.6 pF typ.

Maximum Ratings, *Absolute-Maximum Values:*

COLLECTOR-TO-BASE VOLTAGE, V_{CBO} . . 30 max. V
COLLECTOR-TO-EMITTER VOLTAGE, V_{CEO} 15 max. V
EMITTER-TO-BASE VOLTAGE, V_{EBO} . . . 2.5 max. V
COLLECTOR CURRENT, I_C . . . . 40 max. mA
TRANSISTOR DISSIPATION, P_T:
At case temperatures* $\begin{cases}\text{up to } 25^\circ \text{ C} \\ \text{above } 25^\circ \text{ C}\end{cases}$ . . . . . 300 max. mW . . Derate at 1.72 mW/°C
At ambient temperatures $\begin{cases}\text{up to } 25^\circ\text{C} \\ \text{above } 25^\circ \text{ C}\end{cases}$ . . . . . . 200 max. mW . . Derate at 1.14 mW/°C

TEMPERATURE RANGE:
Storage and Operating (Junction) -65 to +200 °C
LEAD TEMPERATURE (During soldering):
At distances ≥ 1/32 inch from seating surface for 10 seconds max . . . . 265 max. °C

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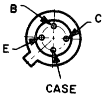
* Measured at center of seating surface.

TERMINAL DESIGNATIONS



92CS-27513

JEDEC TO-72

ELECTRICAL CHARACTERISTICS, *At an Ambient Temperature, T_A = 25° C, Unless Otherwise Specified*

Characteristic	Symbol	Frequency f	TEST CONDITIONS						LIMITS			Units
			DC Collector-to-Base Voltage V_{CB}	DC Collector-to-Emitter Voltage V_{CE}	DC Emitter-to-Base Voltage V_{EB}	DC Emitter Current I_E	DC Base Current I_B	DC Collector Current I_C	Type 2N2857			
		MHz	V	V	V	mA	mA	mA	Min.	Typ.	Max.	
Collector-Cutoff Current	I_{CBO}	T_A = 25°C T_A = 150°C	15 15			0 0			-	-	10 1.0	nA μA
Collector-to-Base Breakdown Voltage	BV_{CBO}					0		0.001	30	-	-	V
Collector-to-Emitter Breakdown Voltage	BV_{CEO}						0	3	15	-	-	V
Emitter-to-Base Breakdown Voltage	BV_{EBO}					-0.01		0	2.5	-	-	V
Static Forward-Current Transfer Ratio	h_{FE}			1				3	30	-	150	
Small-Signal Forward-Current Transfer Ratio	h_{fe}	0.001[c] 100[c]		6 6				2 5	50 10	- -	220 19	
Collector-to-Base Feedback Capacitance	C_{cb}	0.1 to 1[b]	10			0			-	0.6	1.0	pF
Input Capacitance	C_{ib}	0.1 to 1[a]			0.5			0	-	1.4	-	pF
Collector-to-Base Time Constant	$r_b'C_c$	31.9[c]	6			-2			4	7	15	ps
Small-Signal, Common-Emitter Power Gain in Neutralized Amplifier Circuit	G_{pe}	450[c]		6				1.5	12.5	-	19	dB
Power Output as Oscillator	P_o	≥ 500[a]	10			-12			30	-	-	mW
UHF Device Noise Figure	NF	450[c, d, f]		6				1.5	-	3.8	4.5	dB
UHF Measured Noise Figure	NF	450[c, d]		6				1.5	-	-	5.0	dB
VHF Device Noise Figure	NF	60[b, d]		6				1	-	2.2	-	dB

[a] Fourth lead (case) not connected

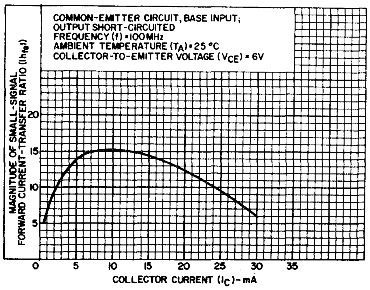
[b] Three-terminal measurement: Lead No.1 (Emitter) and lead No.4 (Case) connected to guard terminal.

[c] Fourth lead (case) grounded.

[d] Generator resistance, R_g = 50 ohms.

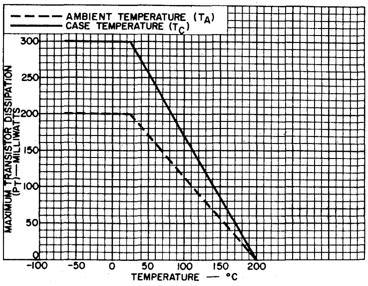
[e] Generator resistance, R_g = 400 ohms.

[f] Device noise figure is approximately 0.5 dB lower than the measured noise figure. The difference is due to the insertion loss at the input of the test circuit (0.25 dB) and the contribution of the following stages in the test set-up (0.25 dB).



92CS-14169R1

Fig. 1 - Small-signal beta characteristic for type 2N2857.



92CS-12483R1

Fig. 2 - Rating chart for type 2N2857.

2N3118

SILICON N-P-N PLANAR TRANSISTOR

For Large-Signal VHF Class-C and Small-Signal VHF Class-A Amplifier Service

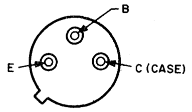
Maximum Ratings, *Absolute-Maximum Values:*

Collector-to-Emitter Voltage:		
Reverse bias (V_{CEX})		
For V_{BE} = -1.5 volts.	85 max.	volts
With base open (V_{CEO})	60 max.	volts
Emitter-to-Base Voltage (V_{EBO}). .	4 max.	volts
Collector Current (I_C).	0.5 max.	ampere
Transistor Dissipation (P_T):		
At case temperatures up to 25° C	4 max.	watts
At free-air temperatures up to 25° C	1 max.	watt
At temperatures above 25° C	See *Fig.1*	
Temperature Range:		
Storage	-65 to +200	°C
Operating (Junction).	-65 to +200	°C

Features:

- High power dissipation — 4 watts at case temperature of 25° C
- High output power — Class-C service; 28-volt operation: 1 watt minimum at 50 Mc; 0.4 watt minimum at 150 Mc
- High collector-to-emitter voltage ratings — V_{CEX} = 85 volts; V_{CEO} = 60 volts
- High gain-bandwidth product — 380 Mc typical
- High power gain — Class-A service, neutralized: 25 db at 50 Mc, 200 mw output

TERMINAL DESIGNATIONS



92CS-27512

JEDEC TO-5

ELECTRICAL CHARACTERISTICS

Characteristics	Symbols	TEST CONDITIONS								LIMITS		Units
		Case Temperature (T_C) °C	Frequency Mc	DC Collector-to-Base Voltage (volts) V_{CB}	DC Collector-to-Emitter Voltage (volts) V_{CE}	DC Emitter-to-Base Voltage (volts) V_{EB}	DC Collector Current (ma) I_C	DC Emitter Current (ma) I_E	DC Base Current (ma) I_B	Min.	Max.	
Collector-Cutoff Current	I_{CBO}	25(T_{FA})▲ 150(T_{FA})▲		30 30				0 0			0.1 100	μa μa
Emitter-to-Base Breakdown Voltage	BV_{EBO}	25					0	0.1		4		volts
Collector-to-Emitter Breakdown Voltage (Sustaining)	BV_{CEO}(sus)	25					10 pulsed□		0	60		volts
Reverse Collector-to-Emitter Breakdown Voltage	BV_{CEX}	25				1.5	0.1			85		volts
Feedback Capacitance	$C_{b'c}$	25	1	28			0				6	pf
$r_{bb'}$ $C_{b'c}$ Product	$r_{bb'}C_{b'c}$	25	50		28		25				60	psec
DC Forward-Current Transfer Ratio□	h_{FE}	25			28		25			50	275	
Small-Signal Forward-Current Transfer Ratio	h_{fe}	25	50		28		25			5		
Real Part of Short-Circuit Input Impedance	$h_{ie(real)}$	25	50		28		25			25	75	ohms
Real Part of Short-Circuit Output Impedance	$1/Y_{22(real)}$	25	50		28		25			500	1000	ohms
Output Power Class-C Service P_{in} = 0.1 watt (with heat sink)	P_{OUT}	25 25	50 150		28 28					1.0 0.4		watt watt
Power Gain Class-A Service P_{out} = 0.2 watt (with heat sink)	PG	25	50		28		25			18		db

▲ T_{FA} = free-air temperature □ Pulse duration, 300 μsec; duty factor, less than 1.8%

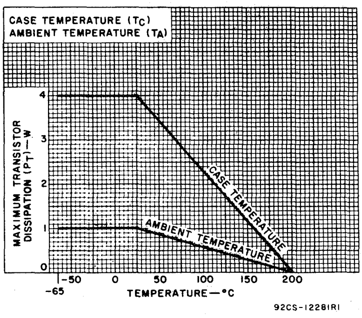


Fig. 1 - Rating chart.

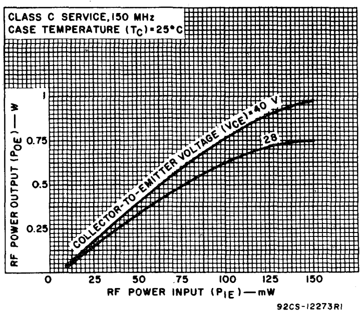


Fig. 2 - Power output as a function of power input at 150 Mc.

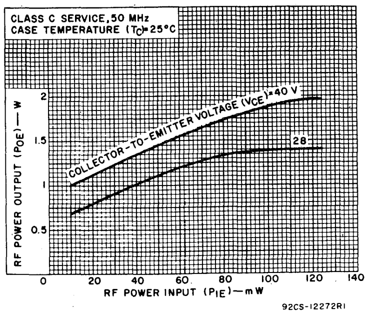


Fig. 3 - Power output as a function of power input at 50 Mc.

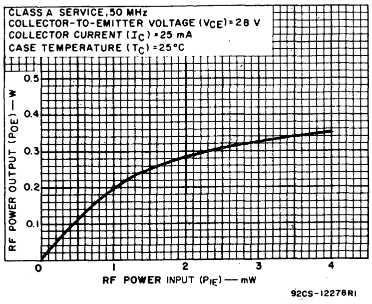


Fig. 4 - Power output as a function of power input at 50 Mc and 25 mA.

2N3119

High-Power Silicon N-P-N Planar Transistor

For Switching and Pulse-Amplifier Applications

Features:

- **High voltage ratings:**
  V_{CEX} = 100 V, V_{CEO} = 80 V
- **Fast rise time:**
  10 ns with 50-V pulse, 1-KΩ load
- **High power dissipation:**
  4 W at T_C = 25° C

MAXIMUM RATINGS, *Absolute-Maximum Values:*

*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	100	V
COLLECTOR-TO-EMITTER VOLTAGE:			
* With base open	V_{CEO}	80	V
With base-emitter junction reverse-biased (V_{BE} = −1.5 V)	V_{CEX}	100	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	4	V
*COLLECTOR CURRENT:	I_C		
Continuous		0.5	A
*TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 25° C		4	W
At free-air temperatures up to 25° C		1	W
At temperatures above 25° C		See Fig. 1	
*TEMPERATURE RANGE:			
Storage & Operating (Junction)		−65 to +200	°C
*LEAD TEMPERATURE (During soldering):			
At 1/16 in. ± 1/32 in. (1.59 mm ± 0.8 mm) from seating plane for 10 s max.		255	°C

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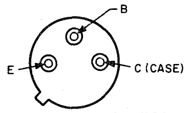
*In accordance with JEDEC registration data format

TERMINAL DESIGNATIONS



JEDEC TO-5

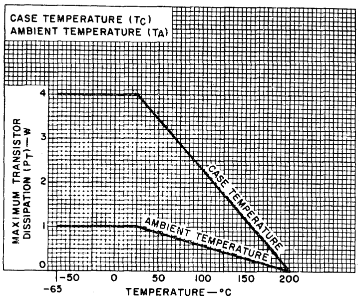


Fig. 1 - Rating chart.

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25° C unless otherwise specified.*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS						LIMITS		UNITS
		DC COLLECTOR VOLTS		DC EMITTER VOLTS	DC CURRENT (MILLIAMPERES)			MIN.	MAX.	
		V_{CB}	V_{CE}	V_{BE}	I_E	I_B	I_C			
* Collector-Cutoff Current At T_{FA} = 25° C = 150° C	I_{CBO}	60 60			0 0			– –	50 50	nA µA
* Reverse Collector Current	I_{CEV}		60	−1.5				–	0.2	µA
* Emitter-Cutoff Current (At T_{FA} = 25° C)	I_{EBO}			−3			0	–	100	nA
* Base Current	I_B		60	−1.5				–	0.2	µA
* Collector-to-Emitter Breakdown Voltage (Sustaining)	$BV_{CEO}(sus)$					0	10●	80	–	V
* Reverse Collector-to-Emitter Breakdown Voltage	BV_{CEX}			−1.5			0.10	100	–	V
* Collector-to-Base Breakdown Voltage	BV_{CBO}				0		0.10	100	–	V
* Emitter-to-Base Breakdown Voltage	BV_{EBO}				0.10		0	4	–	V
* DC Forward-Current Transfer Ratio	h_{FE}		10 10● 10●				10 100 250	40 50 20	– 200 –	
* Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$					10	100	–	0.5	V
* Base-to-Emitter Saturation Voltage	$V_{BE}(sat)$					10	100	–	1.1	V
* Base-to-Emitter Voltage (Pulsed)	V_{BE}		10●				100	–	1.1	V
Feedback Capacitance (At 1 Mc)	$C_{b'c}$	28					0	–	6	pF
* Common-Base Output Capacitance (at 1 mC)	C_{ob}	28					0	–	6	pF
* Gain-Bandwidth Product (At 50 Mc)	f_T		28				25	250	–	Mc
* Pulse-Amplifier Delay + Rise Time	$t_d + t_r$		V_{CC} = 80				10	–	20	ns
Sat. Switch Turn-On Time (delay time + rise time)	t_{on}		V_{CC} = 28			I_{B_1} = 10	100	–	40	ns
Sat. Switch Turn-Off Time (storage time + fall time)	t_{off}		V_{CC} = 28			I_{B_2} = −10	100	–	700	ns
Thermal Resistance: (Junction-to-Case)	$R_{\theta JC}$							–	44	°C/W

*In accordance with JEDEC registration data format

●Pulsed; pulse duration = 300 µsec; duty factor = 1.8%

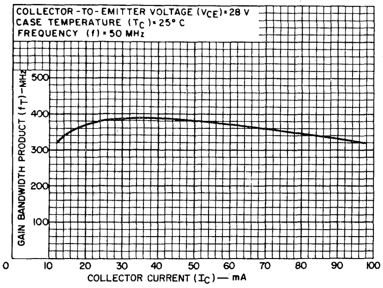


Fig. 2 - Typical gain-bandwidth product characteristic,

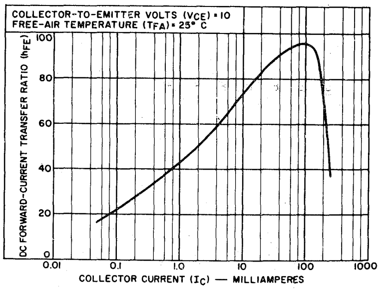


Fig. 3 - Typical dc beta characteristic.

2N3229

SILICON N-P-N PLANAR TRANSISTOR

For Large-Signal, High-Power, VHF Applications in Military and Industrial Communications Equipment

Maximum Ratings, *Absolute-Maximum Values:*

COLLECTOR-TO-BASE VOLTAGE, V_{CBO}. . 105 max. volts

COLLECTOR-TO-EMITTER VOLTAGE:

With base open, V_{CEO} . . . . 60 max. volts

With V_{BE} = -1.5 volts, V_{CEV}. . . 105 max. volts

EMITTER-TO-BASE VOLTAGE, V_{EBO}. . . 4 max. volts

COLLECTOR CURRENT, I_C. . . . . 2.5 max. amperes

TRANSISTOR DISSIPATION, P_T:

At case temperatures up to 25° C. . . . . 17.5 max. watts

At case temperatures above 25° C. . . . . .Derate linearly 100 mw/°C

TEMPERATURE RANGE:

Storage. . . . . -65 to 200 °C

Operating (Junction) . . . . -65 to 200 °C

LEAD TEMPERATURE (During soldering):

At distances $\geq$ 1/32" from ceramic wafer for 10 sec. max. . . . . 230 max. °C

ELECTRICAL CHARACTERISTICS *Case Temperature = 25° C Unless Otherwise Specified*

Characteristic	Symbol	TEST CONDITIONS						LIMITS		Units
		DC Collector Volts		DC Base Volts	DC Current (Milliamperes)					
		V_{CB}	V_{CE}	V_{BE}	I_E	I_B	I_C	Min.	Max.	
Collector-Cutoff Current	I_{CBO}	30			0			-	0.1	μa
Collector-to-Base Breakdown Voltage	BV_{CBO}				0		0.5	105	-	volts
Collector-to-Emitter Breakdown Voltage (Sustaining)	$BV_{CEO(sus)}$					0	500*	60	-	volts
Collector-to-Emitter Breakdown Voltage	BV_{CEV}			-1.5			0.1	105	-	volts
Emitter-to-Base Breakdown Voltage	BV_{EBO}				0.1		0	4	-	volts
Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$					500	2.5 amp	-	1	volt
Feedback Capacitance (Measured at 140 Kc)	$C_{b'c}$	30			0			-	20	pf
RF Power Output, Unneutralized	P_{out}									
Measured at 50 Mc			50				550	15[a]	-	watts
150 Mc			50				250	5[b]	-	watts
Gain-Bandwidth Product	f_T		28				250	200(typ.)		Mc
Base-Spreading Resistance (Measured at 400 Mc)	$r_{bb'}$		28				250	6.0(typ.)		ohms
Collector-to-Case Capacitance	C_c							-	6	pf

* Pulsed. Pulse duration $\leq$ 5 μsec; duty factor $\leq$ 1%.

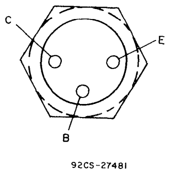
[a] For P_{IN} = 2 watts

[b] For P_{IN} = 1 watt

Features:

- High Power Output, Unneutralized (P_{OUT}):
  15 w min. at 50 Mc
  5 w min. at 150 Mc
- High Voltage Ratings:
  V_{CBO} = 105 volts max.
  V_{CEV} = 105 volts max.
  V_{CEO} = 60 volts max.
- 100 per cent tested to assure freedom from second breakdown in class-A operation at maximum ratings
- Low Thermal Resistance (θ_{J-C})—
  high thermal-conductivity ceramic insulation between collector and mounting stud
- Isolated Stud Package:
  all three electrodes electrically isolated from case—for design flexibility
  heavy copper mounting stud—for effective contact with heat sink
  pin terminals arranged on a .200" pin-circle diameter—fit commercially available sockets

TERMINAL DESIGNATIONS



JEDEC TO-60

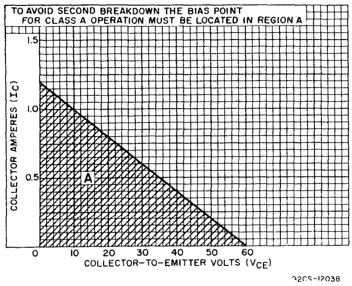


Fig. 1 - Region of safe operation (without second breakdown) in class A service .

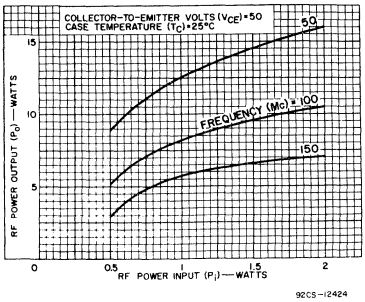


Fig. 2 - Typical operation characteristics.

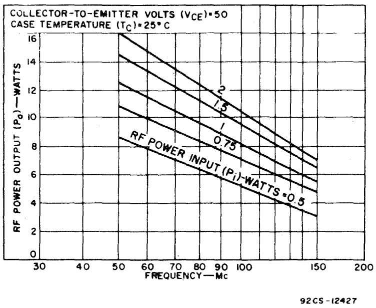


Fig. 3 - Typical operation characteristics.

2N3262

SILICON N-P-N PLANAR TRANSISTOR

For High-Voltage, High-Speed Switching and Pulse-Amplifier Applications

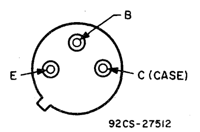
Features:

- High Voltage Ratings —
- Fast Rise Time at High Collector Currents— 20 nsec rise time (max.) at 1 ampere
- High Power Dissipation —
- Low Collector to Emitter Saturation Voltage at High Collector Currents— 0.6 volts (max.) at 1 ampere

Maximum Ratings, *Absolute-Maximum Values:*

Collector-to-Base Voltage, V_{CBO} . . .	100 max.	volts
Collector-to-Emitter Voltage		
Reverse bias, V_{CEX}		
For V_{EB} = 1.5 volts	100 max.	volts
With base open (sustaining voltage), V_{CEO}(sus)	80 max.	volts
Emitter-to-Base Voltage, V_{EBO}	4 max.	volts
Collector Current, I_C	1.5 max.	amperes
Transistor Dissipation, P_T:		
At case temperatures up to 25° C	8.75 max.	watts
At case temperatures above 25° C	Derate linearly (50 mw/°C) to 175° C	
At free-air temperatures up to 25° C	1 max.	watt
At free-air temperatures above 25° C	Derate linearly (5.71 mw/°C) to 175° C	
Temperature Range:		
Storage	-65to+200	°C
Operating (Junction).	-65to+200	°C
Lead Temperature:		
1/16" ± 1/32" from seating surface for 10 sec. max..	230	°C

TERMINAL DESIGNATIONS



JEDEC TO-39

Electrical Characteristics, *Case Temperature = 25° C Unless Otherwise Specified.*

Characteristic	Symbol	TEST CONDITIONS						LIMITS		Units
		DC Collector Volts		DC Emitter Volts	DC Current (Milliamperes)			Min.	Max.	
		V_{CB}	V_{CE}	V_{EB}	I_E	I_B	I_C			
Collector-Cutoff Current at T_{FA} = 25° C	I_{CBO}	30			0				0.1	μa
Emitter-Cutoff Current	I_{EBO}			3			0		100	μa
Collector-to-Emitter Sustaining Voltage with External Base-to-Emitter Resistance (R_{BE}) = 10 ohms	V_{CER}(sus)						500*	90		volts
Collector-to-Emitter Sustaining Voltage	V_{CEO}(sus)					0	500*	80		volts
Reverse Collector-to-Emitter Breakdown Voltage	BV_{CEX}			1.5			0.25	100		volts
Emitter-to-Base Breakdown Voltage	BV_{EBO}				0.1		0	4		volts
Base-to-Emitter Saturation Voltage	V_{BE}(sat)					100	1000		1.4	volts
Collector-to-Emitter Saturation Voltage	V_{CE}(sat)					100	1000		0.6	volts
DC Forward Current Transfer Ratio	h_{FE}		4				500	40		
Input Capacitance (at 1 Mc)	C_{ib}			3			0		300	pf
Feedback Capacitance (at 1 Mc)	$C_{b'c}$	28					0		20	pf
Pulse-Amplifier Rise Time	t_r		V_{cc}=80				25		20	nsec
Sat. Switch Turn-On Time— Delay Time + Rise Time	t_{on}		28		$I_{B1}=I_{B2}$ =100		1000		40	nsec
Sat. Switch Turn-Off Time— Storage + Fall Time	t_{off}		28		$I_{B1}=I_{B2}$ = 100				750	nsec
Forward Current Transfer Ratio (at 50 Mc)	h_{fe}		28				100	3		

* Pulsed; pulse duration = 15 μsec; duty factor = 0.15%.

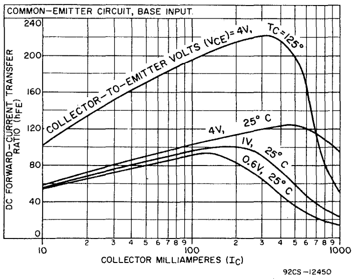


Fig. 1 - DC forward-current transfer ratio as a function of collector current.

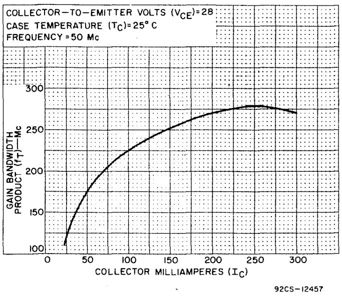


Fig. 2 - Gain-bandwidth product as a function of collector current.

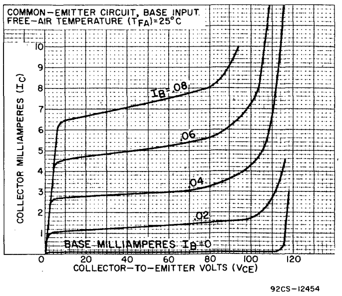


Fig. 3 - Typical transfer characteristics.

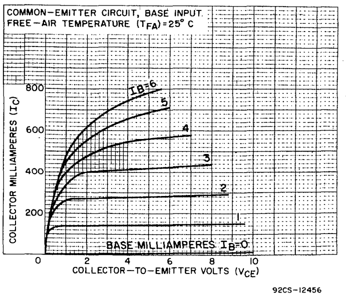


Fig. 4 - Typical small-signal transfer characteristics.

2N3375, 2N3553, 2N3632 , 40665, 40666

SILICON N-P-N OVERLAY TRANSISTORS

For VHF-UHF Applications

Maximum Ratings, *Absolute-Maximum Values:*

		2N3553	2N3375 40666	2N3632 40665	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	65	65	65	V
COLLECTOR-TO-EMITTER VOLTAGE:					
With base open	V_{CEO}	40	40	40	V
With $V_{BE} = -1.5V$ . .	V_{CEV}	65	65	65	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	4	4	4	V
COLLECTOR CURRENT:					
Peak		1.0	1.5	3.0	A
Continuous	I_C	0.33	0.5	1.0	A
TRANSISTOR DISSIPATION	P_T				
At case temperatures up to 25° C		7.0	11.6	23	W

At case temperature above 25° C. Derate linearly to 0 watts at 200° C

	2N3553	2N3375 40666	2N3632 40665	
TEMPERATURE RANGE:				
Storage & Operating (Junction)		-65 to 200		°C
LEAD TEMPERATURE (During soldering):				
At distances ≥ 1/32 in. (.793 mm) from insulating wafer (TO-60 package) or from seating plane (TO-39 package) for 10 s max		230		°C

ELECTRICAL CHARACTERISTICS: *At Case Temperature* $(T_C) = 25°C$

Characteristic	Symbol	TEST CONDITIONS						LIMITS						Units
		DC Collector Volts		DC Base Volts	DC Current (Milliamperes)			40665 2N3632		2N3553		40666 2N3375		
		V_{CB}	V_{CE}	V_{BE}	I_E	I_B	I_C	Min.	Max.	Min.	Max.	Min.	Max.	
Collector-Cutoff Current	I_{CEO}		30			0		-	0.25	-	0.1	-	0.1	mA
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$				0		0.1	-	-	-	-	65	-	V
					0		0.3	-	-	65	-	-	-	
					0		0.5	65	-	-	-	-	-	
Collector-to-Emitter Breakdown Voltage	$V_{(BR)CEO}$					0	0 to 200[a]	40[b]	-	40[b]	-	40[b]	-	V
	$V_{(BR)CEV}$			−1.5			0 to 200[a]	65[b]		65[b]		65[b]	-	V
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$				0.1		0	-	-	4	-	4	-	V
					0.25		0	4	-	-	-	-	-	
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$					100	500	-	1	-	-	-	1	V
						50	250	-	-	-	1	-	-	
Collector-to-Base Capacitance Measured at 1 MHz	C_{obo}	30			0			-	20	-	10	-	10	pF
RF Power Output Amplifier, Unneutralized At 100 MHz	P_{OE}		28					-	-	-	-	7.5[c]	-	W
175 MHz			28					13.5[e]	-	2.5[g]	-	-	-	
260 MHz			28					10[f]	(typ.)	-	-	-	-	
400 MHz			28					-	-	-	-	3[d]	-	
Gain-Bandwidth Product	f_T		28				100	-	-	500 (typ.)		-	-	MHz
			28				150	400 (typ.)		-		500 (typ.)		
Base-Spreading Resistance Measured at 100 MHz	$r_{bb'}$		28				100	-	-	12.0 (typ.)		-	-	ohms
200 MHz			28				250	6.5 (typ.)		-	-	-	-	
400 MHz			28				250	-	-	-	-	10.0 (typ.)		

[a] Pulsed through an inductor (25 mH); duty factor = 50%.

[b] Measured at a current where the breakdown voltage is a minimum.

[c] For P_{IE} = 1.0 W; minimum efficiency = 65%.

[d] For P_{IE} = 1.0 W; minimum efficiency = 40%.

[e] For P_{IE} = 3.5 W; minimum efficiency = 70%.

[f] For P_{IE} = 3.0 W; typical efficiency = 60%.

[g] For P_{IE} = 1/4 W; minimum efficiency = 50%.

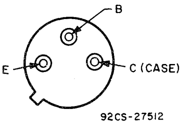
Features:

- **High Power Output, Class-C Amplifier:**

TYPE	400 MHz	260 MHz	175 MHz	100 MHz
2N3632 40665		10 W Typ.	13.5 W Min.	
2N3553		2.5 W Typ.	2.5 W Min.	
2N3375 40666	3 W Min.			7.5 W Min.

- **High Power Output, Oscillator:**
  2.5W (Typ.) at 500 MHz, (2N3375)
  1.5W (Typ.) at 500 MHz, (2N3553)
- **High Voltage Ratings**
- **Internally Grounded Emitter Types (40665 and 40666) available.**

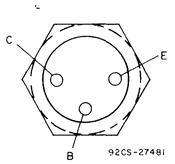
TERMINAL DESIGNATIONS



LEAD 1 - EMITTER
LEAD 2 - BASE
LEAD 3 - COLLECTOR, CASE

2N3553

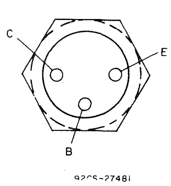
JEDEC TO-39



PIN 1 - EMITTER
PIN 2 - BASE
PIN 3 - COLLECTOR
STUD - NO CONNECTION

2N3632
2N3375

JEDEC TO-60



PIN 1 - EMITTER, CASE
PIN 2 - BASE
PIN 3 - COLLECTOR
STUD - EMITTER

40666
40665

JEDEC TO-60

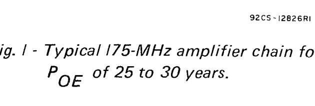


Fig. 1 - Typical 175-MHz amplifier chain for P_{OE} of 25 to 30 years.

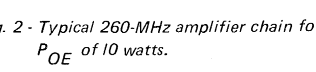


Fig. 2 - Typical 260-MHz amplifier chain for P_{OE} of 10 watts.

All the pins of the 2N3632 and 2N3375 are electrically isolated from the case. In the 40665 and 40666 (variants of types 2N3632 and 2N3375, respectively), the emitter is connected internally to the case.

2N3375, 2N3553, 2N3632, 40665, 40666

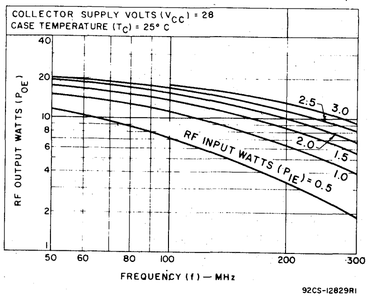


Fig. 3 - Power output as a function of frequency for 2N3632 and 40665.

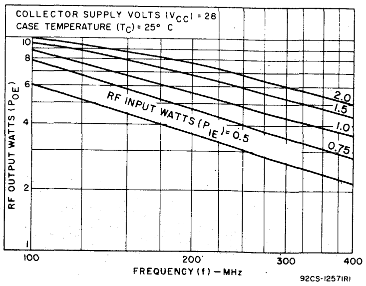


Fig. 4 - Power output as a function of frequency for 2N3375 and 40666.

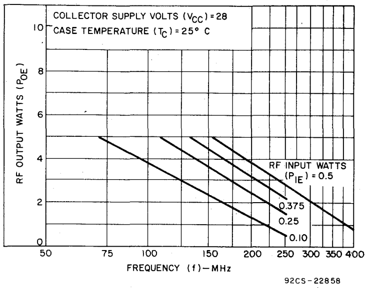


Fig. 5 - Power output as a function of frequency for type 2N3553.

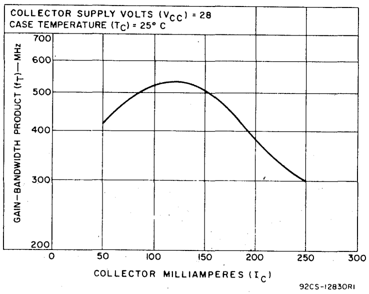


Fig. 6 - Gain-bandwidth product as a function of collector current for types 2N3632 and 40665.

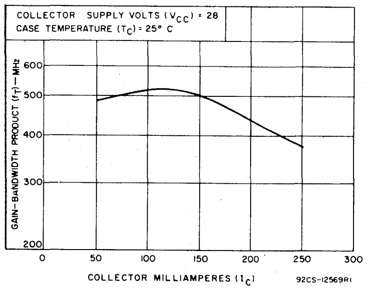


Fig. 7 - Gain-bandwidth product as a function of collector current for types 2N3375 and 40666.

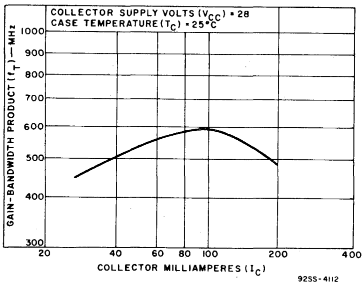


Fig. 8 - Gain-bandwidth product as a function of collector current for 2N3553.

2N3478

SILICON N-P-N EPITAXIAL PLANAR TRANSISTOR

For VHF/UHF Applications in Industrial and Commercial Equipment

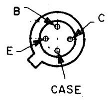
Features:

- high gain-bandwidth product – f_T = 900MHz typ.
- low noise figure
  NF = 5dB typ. at 470MHz
  4.5dB max. at 200MHz
  2.5dB typ. at 60MHz
- high unneutralized power gain
  G_{pe} = 11.5dB min. at 200MHz
- hermetically sealed four-lead package
- all active elements insulated from case
- low collector-to-base feedback capacitance, C_{cb} 0.7pF max.

Maximum Ratings, *Absolute-Maximum Values:*

Collector-to-Base Voltage, V_{CBO}	30 max.	V
Collector-to-Emitter Voltage, V_{CEO}	15 max.	V
Emitter-to-Base Voltage, V_{EBO}	2 max.	V
Collector Current, I_C	limited by dissipation	
Transistor Dissipation, PT:		
at ambient temperatures up to 25° C	200 max.	mW
at ambient temperatures above 25° C	See *Fig. 1*	
Temperature Range:		
Storage and Operating (Junction)	−65 to 200	°C
Lead Temperature (During Soldering):		
At distances not closer than 1/32" to seating surface for 10 seconds max.	265 max.	°C

TERMINAL DESIGNATIONS



92CS-27513

JEDEC TO-72

ELECTRICAL CHARACTERISTICS, *At an Ambient Temperature (T_A) of 25° C*

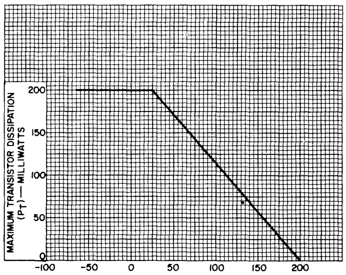
Characteristics	Symbols	TEST CONDITIONS					LIMITS			Units
		Frequency f	DC Collector-to-Base Voltage V_{CB}	DC Collector-to-Emitter Voltage V_{CE}	DC Emitter Current I_E	DC Collector Current I_C	Type 2N3478			
		MHz	V	V	mA	mA	Min.	Typ.	Max.	
Collector-Cutoff Current	I_{CBO}		1		0		–	–	0.02	μA
Collector-to-Base Breakdown Voltage	BV_{CBO}				0	0.001	30	–	–	V
Collector-to-Emitter Breakdown Voltage	BV_{CEO}					0.001	15	–	–	V
Emitter-to-Base Breakdown Voltage	BV_{EBO}				−0.001	0	2	–	–	V
Static Forward-Current Transfer Ratio	h_{FE}			8		2	25	–	150	
Magnitude of Small-Signal Forward-Current Transfer Ratio	h_{fe}[a]	100		8		2	7.5	9	16	
Collector-to-Base Feedback Capacitance	C_{cb}[b]	1	10		0		–	–	1	pF
Small-Signal, Common-Emitter Power Gain in Unneutralized Amplifier Circuit	G_{pe}[a]	200		8		2	11.5	–	17	dB
Small-Signal, Common-Emitter Power Gain in Neutralized Amplifier Circuit	G_{pe}[a, c]	470		6		1.5	–	12	–	dB
UHF Noise Figure	NF[a, c]	470		6		1.5	–	5	–	dB
VHF Noise Figure	NF[a] NF[a, d]	200 60		8 8		2 1	– –	 2.5	4.5 –	dB dB

[a] Fourth lead (case) grounded.

[b] C_{cb} is a three terminal measurement of the collector-to-base capacitance with the emitter and case connected to the guard terminal.

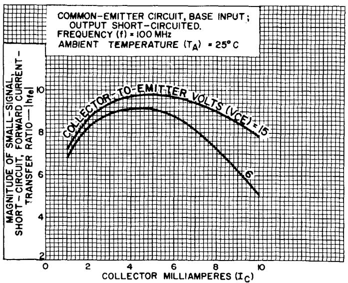
[c] Source Resistance, R_s = 50 ohms.

[d] Source Resistance, R_s = 400 ohms.



92CS-12754R1

Fig. 1 - Rating chart for type 2N3478



92CS-12756R2

Fig. 2 - Typical small-signal beta characteristics for type 2N3478

2N3733

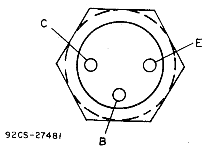
10-W, 400-Mc Silicon N-P-N Overlay Transistor

For Large-Signal, High-Power VHF/UHF Applications

Features:

- High power output, unneutralized Class C amplifier:
  - at 400 Mc 10 W min.
  - at 260 Mc 14.5 W typ.
- High voltage ratings:
  - V_{CBO} = 65 V max.
  - V_{CEV} = 65 V max.
  - V_{CEO} = 40 V max.
- 100 per cent tested to assure freedom from second breakdown for operation in Class A applications
- Low thermal resistance

TERMINAL DESIGNATIONS



JEDEC TO-60

MAXIMUM RATINGS, *Absolute-Maximum Values:*

*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	65	V
COLLECTOR-TO-EMITTER VOLTAGE:			
With base-emitter junction reverse-biased (V_{BE} = -1.5 V)	V_{CEV}	65	V
*With base open	V_{CEO}	40	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	4	V
*COLLECTOR CURRENT:			
Continuous	I_C	1	A
Peak		3	A
*CONTINUOUS BASE CURRENT	I_B	1	A
*TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 25°C		23	W
At case temperatures above 25°C		Derate linearly to 0 watts at 200°C	
*TEMPERATURE RANGE:			
Storage and operating (junction)		-65 to 200	°C
*LEAD TEMPERATURE (During soldering):			
At distances ⩾ 1/32 in. (0.8 mm) from insulating wafer for 10 s max.		230	°C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS						LIMITS		UNITS
		VOLTAGE V dc			CURRENT mA dc					
		V_{CB}	V_{CE}	V_{BE}	I_E	I_B	I_C	MIN.	MAX.	
* Collector Cutoff Current: With base open	I_{CEO}		30			0		-	0.25	mA
With base-emitter junction reverse-biased	I_{CEV}		65	-1.5				-	5	
At T_C = 200°C			30	-1.5				-	10	
With emitter open	I_{CBO}	65						-	0.5	
* Emitter Cutoff Current	I_{EBO}			-4				-	0.25	mA
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$				0		0.5	65	-	V
Collector-to-Emitter Breakdown Voltage: With base-emitter junction reverse-biased	$V_{(BR)CEV}$			-1.5			0 to 200●	65**	-	V
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$				0.25		0	4	-	V
* Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$					0	200	40	-	V
With external base-to-emitter resistance (R_{BE}) = 100 Ω	$V_{CER}(sus)$						200	40	-	
* DC Forward Current Transfer Ratio	h_{FE}		5 5				1 0.25	5 10	- 150	
* Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$					200	1000	-	1	V
* Base-Emitter Voltage	V_{BE}		5				1000	-	1.5	V
Magnitude of Common-Emitter, Small-Signal, Short-Circuit Forward Current Transfer Ratio (f = 100 Mc)	$\|h_{fe}\|$		28 28				250 250	2.5* 4.0 (typ.)	-	
* Collector-to-Base Capacitance (f = 0.1 to 1 Mc)	C_{ob}	28					250	-	25	pF
* Available Amplifier Signal Input Power P_o = 10 W, Z_G = 50 Ω, f = 400 Mc	P_i							-	4	W
* Collector Circuit Efficiency P_o = 10 W, Z_G = 50 Ω, f = 400 Mc	η_C							45	-	%
Base-Spreading Resistance Measured at 200 Mc	$r_{bb'}$		28				250	6.5 (typ.)		Ω
Collector-to-Case Capacitance	C_s							-	6	pF
Thermal Resistance (Junction-to-Case)	$R_{\theta JC}$							-	7.5	°C/W

●Pulsed through an inductor (25 mH); duty factor = 50%

**Measured at a current where the breakdown voltage is a minimum

*In accordance with JEDEC registration data

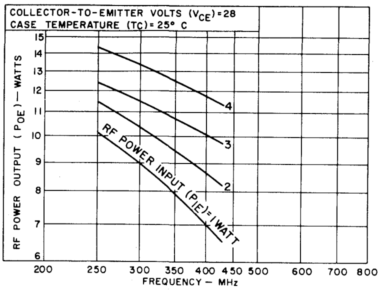


Fig. 1 - Power output as a function of frequency.

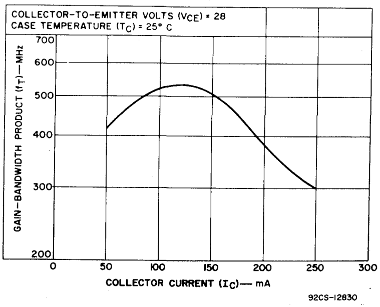


Fig. 2 - Gain-bandwidth product as a function of collector current.

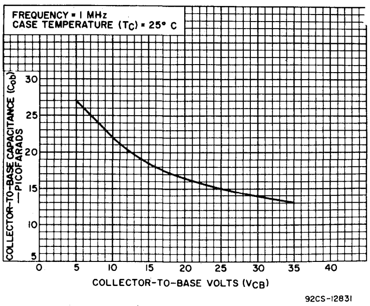


Fig. 3 - Variation of collector-to-base capacitance.

2N3839

SILICON N-P-N EPITAXIAL PLANAR TRANSISTOR

For Low-Noise UHF Applications in Industrial and Military Equipment

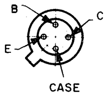
Maximum Ratings, *Absolute-Maximum Values:*

COLLECTOR-TO-BASE VOLTAGE, V_{CBO}	30 max.	V
COLLECTOR-TO-EMITTER VOLTAGE, V_{CEO}	15 max.	V
EMITTER-TO-BASE VOLTAGE, V_{EBO}	2.5 max.	V
COLLECTOR CURRENT, I_C	40 max.	mA
TRANSISTOR DISSIPATION, P_T:		
For operation with heat sink:		
At case temperatures** up to 25°C	300 max.	mW
At case temperatures** above 25°C	Derate at 1.72 mW/°C	
For operation at ambient temperatures:		
At ambient temperatures up to 25°C	200 max.	mW
At ambient temperatures above 25°C	Derate at 1.14 mW/°C	
TEMPERATURE RANGE:		
Storage and Operating (Junction)	-65 to +200	°C
LEAD TEMPERATURE (During Soldering):		
At distances ≥ 1/32 inch from seating surface for 10 seconds max.	265 max.	°C

Features:

- very low device noise figure —
  NF = 3.4 dB max. as 450-MHz amplifier
- high gain-bandwidth product —
  f_T = 1000 MHz min.
- high converter (450-to-30 MHz) gain —
  G_c = 15 dB typ. for circuit bandwidth of approximately 2 MHz
- high power gain as neutralized amplifier —
  G_{pe} = 12.5 dB min. at 450 MHz for circuit bandwidth of 20 MHz
- high power output as UHF oscillator —
  P_o = 30 mW min., 40 mW typ. at 500 MHz
  = 20 mW typ. at 1 GHz
- low collector-to-base time constant —
  $r_b'C_c$ = 7 ps typ.
- low collector-to-base feedback capacitance —
  C_{cb} = 0.6 pF typ.

TERMINAL DESIGNATIONS



92CS-27513

JEDEC TO-72

ELECTRICAL CHARACTERISTICS

CHARACTERISTICS	SYMBOL	TEST CONDITIONS							LIMITS			UNITS
		FREQUENCY f	DC COLLECTOR-TO-BASE VOLTAGE V_{CB}	DC COLLECTOR-TO-EMITTER VOLTAGE V_{CE}	DC EMITTER-TO-BASE VOLTAGE V_{EB}	DC EMITTER CURRENT I_E	DC BASE CURRENT I_B	DC COLLECTOR CURRENT I_C	TYPE 2N3839			
		MHz	V	V	V	mA	mA	mA	Min.	Typ.	Max.	
Collector-Cutoff Current T_A = 25°C T_A = 150°C	I_{CBO}		15 15			0 0			- -	- -	10 1.0	nA μA
Collector-to-Base Breakdown Voltage	BV_{CBO}					0		0.001	30	-	-	V
Collector-to-Emitter Breakdown Voltage	BV_{CEO}						0	3	15	-	-	V
Emitter-to-Base Breakdown Voltage	BV_{EBO}					0.01		0	2.5	-	-	V
Static Forward Current-Transfer Ratio	h_{FE}			1				3	30	-	150	
Small-Signal Forward Current-Transfer Ratio	h_{fe}	0.001[c] 100[c]		6 6				2 5	50 10	- -	220 20	
Collector-to-Base Feedback Capacitance	C_{cb}	0.1 to 1.0[b]	10			0			-	0.6	1.0	pF
Input Capacitance	C_{ib}	0.1 to 1.0			0.5			0	-	1.4	-	pF
Collector-to-Base Time Constant	$r_b'C_c$	31.9[c]	6			-2			1	7	15	ps
Small-Signal, Common-Emitter Power Gain in Neutralized Amplifier Circuit	G_{pe}	450[c]		6				1.5	12.5	-	19	dB
Power Output as Oscillator	P_o	≥500[a]	10			-12			30	-	-	mW
UHF Measured Noise Figure	NF	450[c,d]		6				1.5	-	-	3.9	dB
UHF Device Noise Figure	NF	450[c,d,f]		6				1.5	-	-	3.4	dB
VHF Measured Noise Figure	NF	60[c,e]		6				1	-	2	-	dB

[a] Lead No.4 (case) not connected.

[b] 3-terminal measurement with emitter and case connected to guard terminal.

[c] Lead No.4 (case) grounded.

[d] Generator resistance, R_g = 50 ohms.

[e] Generator resistance, R_g = 400 ohms.

[f] Device noise figure is approximately 0.5 dB lower than the meas--sured noise figure. The difference is due to the insertion loss at the input of the test circuit (0.25 dB) and the contribution of the following stages in the test setup (0.25 dB).

2N3866

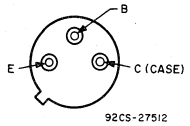
Silicon N-P-N Overlay Transistor

High-Gain Driver for VHF/UHF Applications in Military and Industrial Communications Equipment

Features

- High Power Gain, Unneutralized Class C Amplifier
  - 1 W output at 400 MHz (10 dB gain)
  - 1 W output at 250 MHz (15 dB gain)
  - 1 W output at 175 MHz (17 dB gain)
  - 1 W output at 100 MHz (20 dB gain)
- Low Output Capacitance
  C_{obo} = 3 pF max.

TERMINAL DESIGNATIONS



JEDEC TO-39

MAXIMUM RATINGS, *Absolute-Maximum Values:*

* COLLECTOR-TO-BASE VOLTAGE . . .	V_{CBO}	55	V
COLLECTOR-TO-EMITTER VOLTAGE:			
With external base-to-emitter resistance (R_{BE}) = 10Ω.	V_{CER}	55	V
* With base open	V_{CEO}	30	V
* EMITTER-TO-BASE VOLTAGE	V_{EBO}	3.5	V
* CONTINUOUS COLLECTOR CURRENT	I_C	0.4	A
* CONTINUOUS BASE CURRENT	I_B	0.4	A
* TRANSISTOR DISSIPATION	P_T		
At case temperature up to 25°C		5	W
At case temperatures above 25°C . . .		See Fig. 2.	
* TEMPERATURE RANGE:			
Storage & Operating (Junction).		−65 to +200	°C
* LEAD TEMPERATURE			
At distances ≥ 1/16 in. (1.58 mm) from seating plane for 10 s max.		230	°C

ELECTRICAL CHARACTERISTICS, At Case Temperature (T_C) = 25°C

STATIC

CHARACTERISTIC	SYMBOL	TEST CONDITIONS					LIMITS		UNITS
		DC Voltage (V)		DC Current (mA)					
		V_{CE}	V_{EB}	I_E	I_B	I_C	Min.	Max.	
* Collector-Cutoff Current: Base-emitter junction reverse biased	I_{CEX}	55	1.5				–	0.1	mA
T_C = 200°C		30	1.5				–	0.1	
Base open	I_{CEO}	28			0		–	20	μA
* Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$			0		0.1	55	–	V
* Collector-to-Emitter Breakdown Voltage: With base open	$V_{(BR)CEO}$				0	5	30	–	V
With base connected to emitter through 10-ohm resistor	$V_{(BR)CER}$		0			5	55	–	
* Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$			0.1		0	3.5	–	V
* Emitter-Cutoff Current	I_{EBO}		3.5				–	0.1	mA
* Collector-to-Emitter Saturation Voltage	V_{CE}(sat)				20	100	–	1.0	V
* DC Forward-Current Transfer Ratio	h_{FE}	5 5				360 50	5 10	– 200	
Thermal Resistance: (Junction-to-Case)	$\theta_{J\text{-}C}$						–	35	°C/W

DYNAMIC

TEST & CONDITIONS	SYMBOL	FREQUENCY MHz	LIMITS		UNITS
			MINIMUM	MAXIMUM	
Power Output (V_{CC} = 28 V): P_{IE} = 0.1 W	P_{OE}	400	1.0	–	W
Large-Signal Common-Emitter Power Gain (V_{CC} = 28 V): P_{IE} = 0.1 W	G_{PE}	400	10	–	dB
* Collector Efficiency (V_{CC} = 28 V): P_{IE} = 0.1 W, P_{OE} = 1 W, Source Impedance = 50Ω	η_C	400	45	–	%
* Magnitude of Common-Emitter, Small Signal, Short-Circuit Forward-Current Transfer Ratio I_C = 50 mA, V_{CE} = 15 V	$\lvert h_{fe} \rvert$	200	2.5	–	
* Available Amplifier Signal Input Power, P_{OE} = 1 W, Source Impedance = 50Ω	P_i	400	–	0.1	W
* Common-Base Output Capacitance (V_{CB} = 28 V)	C_{obo}	1	–	3	pF

* In accordance with JEDEC registration data format JS-6 RDF-3

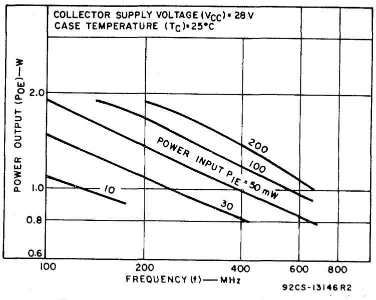


Fig. 1 - Power output as a function of frequency.

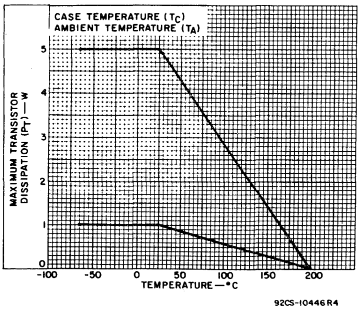


Fig. 2 - Dissipation derating curve.

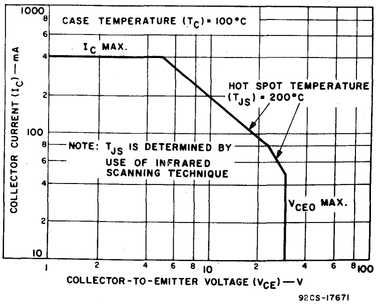


Fig. 3 - Safe area for dc operation.

2N4012

High-Power Silicon N-P-N Overlay Transistor

For Applications as a Frequency Multiplier
Into the UHF or L-Band Range

Features

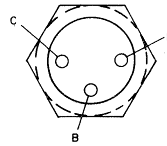
- 2.5 W output with 4 dB conversion gain (min.) as tripler to 1 GHz
- 3 W output with 4.8 dB conversion gain (typ.) as doubler to 800 MHz
- High voltage ratings
- Freedom from second breakdown

MAXIMUM RATINGS, *Absolute-Maximum Values:*

COLLECTOR-TO-EMITTER VOLTAGE:			
With base open	V_{CEO}	40	V
With V_{BE} = −1.5 volts............	V_{CEV}	65	V
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	65	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	4	V
COLLECTOR CURRENT	I_C	1.5	A

TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 25°C ...		11.6	W
At case temperatures above 25°C ...		See Fig. 5	
TEMPERATURE RANGE:			
Storage & Operating (Junction)		−65 to +200	°C
LEAD TEMPERATURE (During soldering):			
At distances ≥ 1/32 in. (0.8 mm) from insulating wafer for 10 s max.		230	°C

TERMINAL DESIGNATIONS



JEDEC TO-60

ELECTRICAL CHARACTERISTICS, Case Temperature = 25°C

CHARACTERISTIC	SYMBOL	TEST CONDITIONS						LIMITS		UNITS
		DC Collector Volts		DC Base Volts	DC Current (Milliamperes)					
		V_{CB}	V_{CE}	V_{BE}	I_E	I_B	I_C	Min.	Max.	
Collector-Cutoff Current	I_{CEO}		30			0		–	0.1	mA
Collector-to-Base Breakdown Voltage	BV_{CBO}				0		0.1	65	–	volts
Collector-to-Emitter Breakdown Voltage	BV_{CEO}					0	0 to 200[a]	40[b]	–	volts
	BV_{CEV}			-1.5			0 to 200[a]	65[b]	–	volts
Emitter-to-Base Breakdown Voltage	BV_{EBO}				0.1		0	4	–	volts
Collector-to-Emitter Saturation Voltage	V_{CE}(sat)					100	500	–	1	volt
Collector-to-Base Capacitance	C_{ob}	30			0			–	10	pF
RF Power Output Tripler At 1002 Mc/s Doubler At 800 Mc/s	P_{OUT}		28 28					2.5[c] 3.0[d] (typ.)		watts
Gain-Bandwidth Product	f_T		28				150	500 (typ.)		Mc/s
Collector-to-Base Cutoff Frequency[e]	f_c		28				0	25 (typ.)		Gc/s

[a] Pulsed through an inductor (25 mH); duty factor = 50%.

[b] Measured at a current where the breakdown voltage is a minimum.

[c] For P_{IN} = 1.0 W; at 334 Mc/s; minimum collector efficiency = 25%.

[d] For P_{IN} = 1.0 W; at 400 Mc/s; typical collector efficiency = 35%.

[e] Cutoff frequency is determined from Q measurement at 210 Mc/s. The cutoff frequency of the collector-to-base junction of the transistor, f_c = Q x 210 Mc/s.

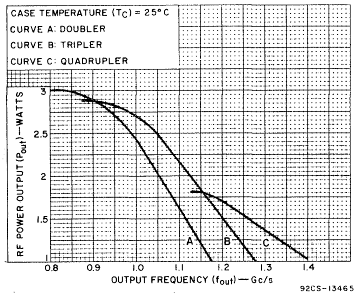


Fig. 1 - Output power as a function of output frequency.

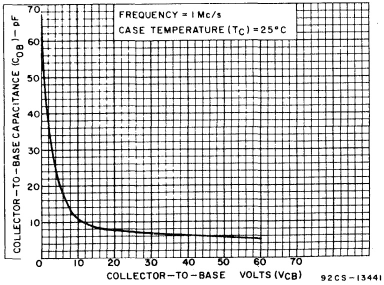


Fig. 2 - Collector-to-base capacitance as a function of collector-to-base voltage.

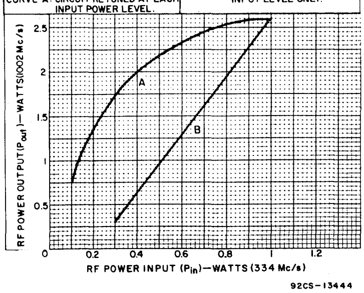


Fig. 3 - Power output as a function of power input.

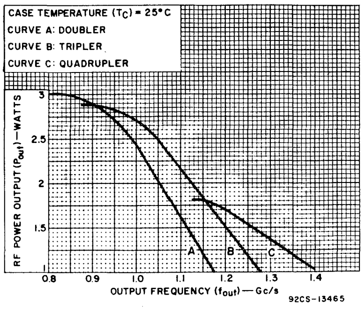


Fig. 4 - Power output as a function of collector supply voltage

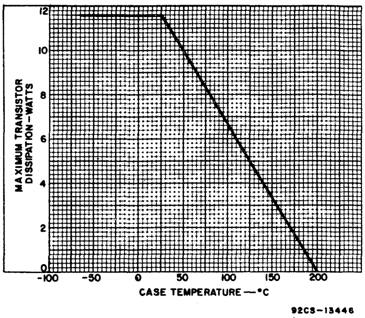


Fig. 5 - Dissipation derating curve.

2N4427

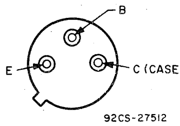
Silicon N-P-N Overlay Transistor

High-Gain Driver for VHF-UHF

Features:

- 1 W output with 10 dB gain (min.) at 175 MHz
  V_{CC} = 12 V
- 0.4 W output with 5 dB gain (typ.) at 470 MHz
  V_{CC} = 12 V

TERMINAL DESIGNATIONS



JEDEC TO-39

MAXIMUM RATINGS, *Absolute-Maximum Values:*

* COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	40	V
* COLLECTOR-TO-EMITTER VOLTAGE:			
With base open	V_{CEO}	20	V
* EMITTER-TO-BASE VOLTAGE	V_{EBO}	2	V
* CONTINUOUS COLLECTOR CURRENT	I_C	0.4	A
* CONTINUOUS BASE CURRENT	I_B	0.4	A
* TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 100°C		2	W
* TEMPERATURE RANGE:			
Storage & Operating (Junction)		−65 to 200	°C
* LEAD TEMPERATURE (During soldering):			
At distances $\geq$ 1/32 in. (0.8 mm) from insulating wafer for 10 s max.		230	°C

* In accordance with JEDEC registration data format JS-6 RDF-3.

ELECTRICAL CHARACTERISTICS, At Case Temperature (T_C) = 25°C.

Characteristic	Symbol	TEST CONDITIONS DC Voltage (V)				DC Current (mA)			Limits		Units
		V_{BE}	V_{EB}	V_{CB}	V_{CE}	I_E	I_B	I_C	Min.	Max.	
* Collector-Cutoff Current: With base open	I_{CEO}				12		0		–	0.02	mA
With base-emitter junction reverse-biased	I_{CEV}	−1.5			40				–	0.1	
T_C = 150°C		−1.5			12				–	5	
* Emitter-Cutoff Current	I_{EBO}		2						–	0.1	mA
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$					0		0.1	40	–	V
* Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$						0	5	20	–	V
With external base-to-emitter resistance (R_{BE}) = 10Ω	$V_{CER}(sus)$							5	40	–	
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$					0.1		0	2	–	V
* Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$						20	100	–	0.5	V
* DC Forward Current Transfer Ratio	h_{FE}				5 5			360 100	5 10	– 200	
* Magnitude of Common-Emitter Small-Signal, Short-Circuit Forward Current Transfer Ratio (f = 200 MHz)	$\lvert h_{fe} \rvert$				15			50	2.5	–	
* Collector-to-Base Capacitance (f = 1 MHz)	C_{ob}			12		0			–	4	pF
RF Power Output Class C Amplifier, Unneutralized (f = 175 MHz, P_{IE} = 0.1 W, $\eta_C \geq$ 50%)	P_{OE}			12 (V_{CC})					1	–	W
* Available Amplifier Signal Input Power (f = 175 MHz, P_{OE} = 1 W, Z_{IN} = 50 Ω)	P_i			12 (V_{CC})					–	0.1	W
* Collector Efficiency (f = 175 MHz, P_{OE} = 1 W, Z_{IN} = 50 Ω)	η_C			12 (V_{CC})					50	–	%
Thermal Resistance Junction-to-Case	$R_{\theta JC}$								–	50	°C/W

* In accordance with JEDEC registration data format JS–6 RDF–3.

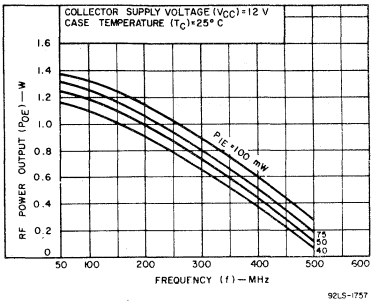


Fig. 1 - Power output as a function of frequency.

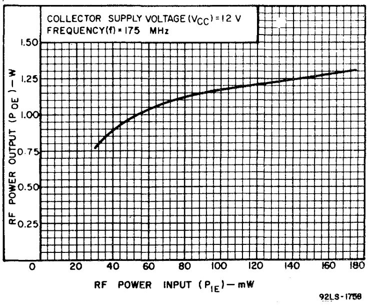


Fig. 2 - Power output as a function of power input at 175 MHz.

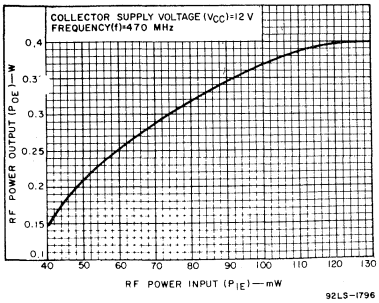


Fig. 3 - Power output as a function of power input at 470 MHz.

2N4440

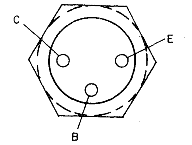
Silicon N-P-N Overlay Transistor

For Class A, B, or C VHF/UHF
Military and Industrial Communications Equipment

Features:

- 5 W output min. at 400 MHz
- 6.5 W output typ. at 225 MHz

TERMINAL DESIGNATIONS



JEDEC TO-60

MAXIMUM RATINGS, *Absolute-Maximum Values:*

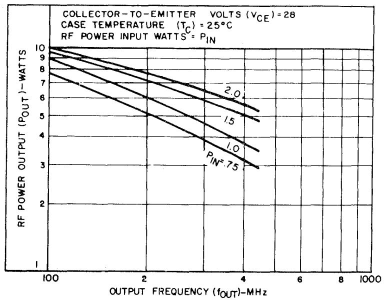
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	65	V
*COLLECTOR-TO-EMITTER VOLTAGE:			
With base-emitter junction reverse-biased (V_{BE}) = -1.5 V	V_{CEV}	65	V
* With base open	V_{CEO}	40	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	4	V
*CONTINUOUS COLLECTOR CURRENT	I_C	1.5	A
*CONTINUOUS BASE CURRENT	I_B	0.2	A
*TRANSISTOR DISSIPATION▲:	P_T		
At case temperatures up to 25°C		11.6	W
At case temperatures above 25°C		See Fig. 2	
*TEMPERATURE RANGE:			
Storage and operating (junction)		-65 to 200	°C
LEAD TEMPERATURE (During soldering):			
At distances ⩾ 1/32 in. (0.8 mm) from insulating wafer for 10 s max		230	°C

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS						LIMITS		UNITS
		VOLTAGE V dc			CURRENT mA dc					
		V_{CB}	V_{CE}	V_{BE}	I_E	I_B	I_C	MIN.	MAX.	
* Collector Cutoff Current: With base open	I_{CEO}		30			0		-	0.1	mA
With base-emitter junction reverse-biased	I_{CEV}		65	-1.5				-	1	
At T_C = 200°C			30	-1.5				-	5	
* Emitter Cutoff Current	I_{EBO}			-4				-	0.1	mA
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$				0		0.1	65	-	V
Collector-to-Emitter Breakdown Voltage: With base-emitter junction reverse-biased	$V_{(BR)CEV}$			-1.5			0 to 200●	65**	-	V
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$				0.1		0	4	-	V
* Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$					0	200●	40	-	V
With external base-to-emitter resistance (R_{BE}) = 100Ω	$V_{CER}(sus)$						200●	40	-	
* DC Forward Current Transfer Ratio	h_{FE}		5 5				1350 125	3 10	- 200	
* Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$					50	250	-	1	V
Magnitude of Common-Emitter, Small-Signal, Short-Circuit Forward Current Transfer Ratio (f = 100 MHz)	$\|h_{fe}\|$		28				125	4* 5 (typ.)	-	
* Collector-to-Base Capacitance (f = 1 MHz)	C_{ob}	28					125	-	12	pF
* Available Amplifier Signal Input Power (P_o = 5 W, Z_G = 50Ω, f = 400 MHz)	P_i							-	1.7	W
* Collector Circuit Efficiency (P_o = 5 W, Z_G = 50Ω, f = 400 MHz)	η_C							45	-	%
Base-Spreading Resistance Measured at 200 MHz	$r_{bb'}$		28				250	10 (typ.)		Ω
Collector-to-Case Capacitance	C_s							-	6	pF
Thermal Resistance (Junction-to-Case)	$R_{\theta JC}$							-	15	°C/W

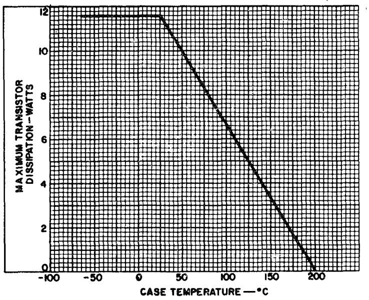
●Pulsed through an inductor (25 mH); duty factor=50%
**Measured at a current where the breakdown voltage is a minimum
*In accordance with JEDEC registration data.

▲Secondary breakdown considerations limit maximum dc operating conditions. . .contact your RCA Representative for specific data.



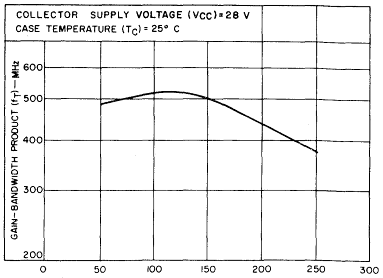
92LS-1571R1

Fig. 1 - Typical power output as a function of frequency.



92CS-13446

Fig. 2 - Dissipation derating chart.



92CS-12569R2

Fig. 3 - Typical gain-bandwidth product as a function of collector current.

2N4932, 2N4933

SILICON N-P-N "overlay" TRANSISTORS

For International VHF Mobile and Portable Communication, 66 to 88 MHz

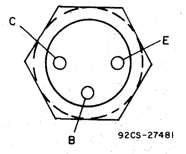
Features:

Operation From a Power Supply of –
13.5 volts (2N4932)
24 volts (2N4933)

Power Output (Min.) at 88 MHz
12 watts (2N4932)
20 watts (2N4933)

Load Protection
High Voltage Ratings

TERMINAL DESIGNATIONS



JEDEC TO-60

RATINGS

Maximum Ratings, *Absolute-Maximum Values:*

		2N4932	2N4933	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	50	70	V
COLLECTOR-TO-EMITTER VOLTAGE:				
With base open	V_{CEO}	25	35	V
With V_{BE} = −1.5V	V_{CEV}	50	70	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	4.0		V
COLLECTOR CURRENT:				
Peak		10		A
Continuous	I_C	3.3		A

		2N4932 2N4933	
RF INPUT POWER	P_{in}		
At 88 MHz		3.5	W
TRANSISTOR DISSIPATION	P_T		
At case temperatures up to 25° C		70	W
TEMPERATURE RANGE:			
Storage & Operating (Junction)		−65 to 200	°C
LEAD TEMPERATURE (During soldering):			
At distances ≧ 1/32 in. from insulating wafer for 10 s max.		230	°C

ELECTRICAL CHARACTERISTICS FOR 2N4932

Case Temperature = 25° C

Characteristic	Symbol	TEST CONDITIONS						Limits		Units
		DC Collector Volts		DC Base Volts	DC Current (Milliamperes)					
		V_{CB}	V_{CE}	V_{BE}	I_E	I_B	I_C	Min.	Max.	
Collector-Cutoff Current	I_{CEO}		15			0			1.0	mA
	I_{CBO}	40			0				10	mA
Collector-to-Emitter Breakdown Voltage	$V_{CEV}(sus)$			−1.5			200[a]	50		V
	$V_{CEO}(sus)$					0	200[a]	25		V
Emitter-to-Base Breakdown Voltage	BV_{EBO}				10		0	4		V
Collector-to-Base Capacitance	C_{ob}	15			0				120	pF
RF Power Output	P_{out}							12[c]		W

ELECTRICAL CHARACTERISTICS FOR 2N4933

Case Temperature = 25° C

Characteristic	Symbol	TEST CONDITIONS						Limits		Units
		DC Collector Volts		DC Base Volts	DC Current (Milliamperes)					
		V_{CB}	V_{CE}	V_{BE}	I_E	I_B	I_C	Min.	Max.	
Collector-Cutoff Current	I_{CEO}		30			0			1.0	mA
	I_{CBO}	50			0				10	mA
Collector-to-Emitter Breakdown Voltage	$V_{CEV}(sus)$			−1.5			200[a]	70		V
	$V_{CEO}(sus)$					0	200[a]	35		V
Emitter-to-Base Breakdown Voltage	BV_{EBO}				10		0	4		V
Collector-to-Base Capacitance	C_{ob}	30			0				85	pF
RF Power Output	P_{out}							20[b]		W

[a] Pulsed through an inductor (25mH), duty factor = 50%

[b] For P_{in} = 3.5 W, at 88 MHz; V_{cc} = 24V, minimum efficiency = 70%

[c] For P_{in} = 3.5 W, at 88 MHz; V_{cc} = 13.5V, minimum efficiency = 70%

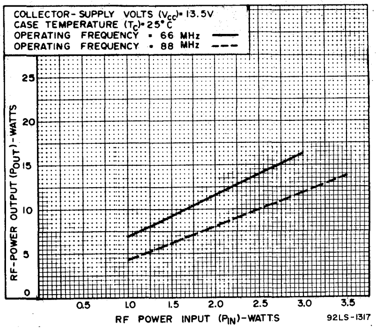


Fig. 1 - Typical power output as a function of power input for the 2N4932.

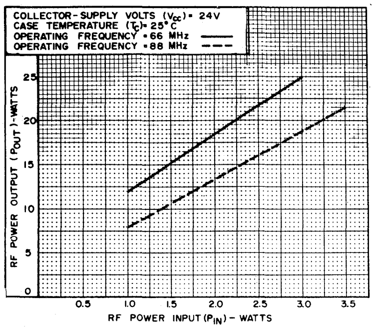


Fig. 2 - Typical power output as a function of power input for the 2N4933.

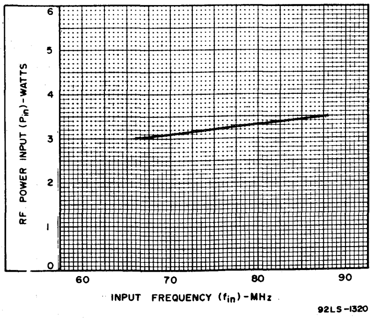


Fig. 3 - Input derating curve.

2N5016

High-Power Silicon N-P-N Overlay Transistor

For VHF/UHF Communications Equipment

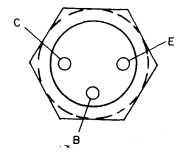
Features:

- **For class B or C vhf/uhf military and industrial communications**
- **15 W output (min.) at 400 MHz**
- **23 W output (typ.) at 225 MHz**
- **Emitter grounded to case**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	65	V
COLLECTOR-TO-EMITTER VOLTAGE:			
With base-emitter junction reverse-biased, V_{BE} = −1.5 V	V_{CEV}	65	V
With external base-to-emitter resistance, R_{BE} = 30 Ω	V_{CER}	40	V
* With base open	V_{CEO}	30	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	4	V
*CONTINUOUS COLLECTOR CURRENT	I_C	4.5	A
*CONTINUOUS BASE CURRENT	I_B	1.5	A
*TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 50°C		30	W
At case temperatures above 50°C		See Fig. 1	
*TEMPERATURE RANGE:			
Storage & Operating (Junction)		−65 to 200	°C
*LEAD TEMPERATURE (During soldering):			
At distances ≥1/32 in. (0.8 mm) from insulating wafer for 10 s max.		230	°C

TERMINAL DESIGNATIONS



92CS-27481

JEDEC TO-60

ELECTRICAL CHARACTERISTICS, *Case Temperature (T_C) = 25°C*

STATIC

CHARACTERISTIC	SYMBOL	TEST CONDITIONS: DC COLLECTOR OR BASE VOLTAGE – V			TEST CONDITIONS: DC CURRENT mA			LIMITS		UNITS
		V_{CB}	V_{CE}	V_{BE}	I_E	I_B	I_C	MIN.	MAX.	
Collector-Cutoff Current With base open	I_{CEO}		30			0		–	10	mA
* With base-emitter junction reverse-biased	I_{CEV}		60	-1.5				–	10	
* T_C = 150°C			30	-1.5				–	10	
* Emitter Cutoff Current V_{BE} = 4 V	I_{EBO}							–	5	mA
* Collector-to-Emitter Sustaining Voltage With base open	$V_{CEO}(sus)$					0	200[a]	30	–	V
* With external base-to-emitter resistance (R_{BE}) = 30 Ω	$V_{CER}(sus)$					0	200[a]	40	–	
With base-emitter junction reverse-biased	$V_{CEV}(sus)$			-1.5			200[a]	65	–	
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$				5		0	4	–	V
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$					400	2000	–	1	V
* DC Forward Current Transfer Ratio	h_{FE}		4 4				4500 500	3 10	– 200	
Thermal Resistance: Junction-to-Case	$R_{\theta J\text{-}C}$							–	5	°C/W

DYNAMIC

* Available Amplifier Signal Input Power (P_{OE} = 15 W, Z_{IN} = 50 Ω, V_{CC} = 28 V, f = 400 MHz)	P_i							–	5	W
* Collector Efficiency (P_{IE} = 5 W, P_{OE} = 15 W, Z_L = 50 Ω, f = 400 MHz)	η_C							50	–	%
* Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio (f = 400 MHz)	$\lvert h_{fe} \rvert$		15				500	1.25	–	
Gain-Bandwidth Product	f_T		15				500	600 (typ.)		MHz
* Collector-to-Base Capacitance (f = 1 MHz)	C_{ob}	30			0			–	25	pF

TYPICAL APPLICATION INFORMATION

RF Power Output Amplifier, Unneutralized At 225 MHz 400 MHz	P_{OE}		28 28					23[b] (typ.) 15[c]	 –	W
Dynamic Input Impedance at 400 MHz	Z_{IN}		28					2.5 + j5 (typ.)[c]		Ω

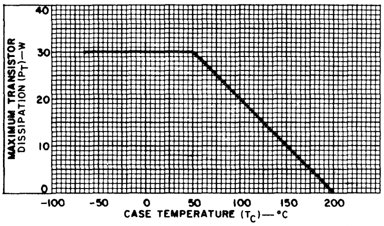


Fig. 1 - Dissipation derating curve.

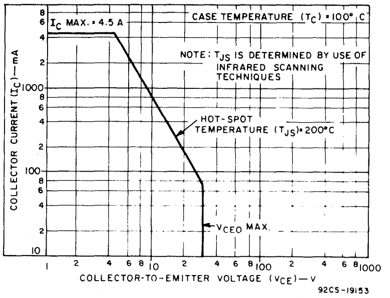


Fig. 2 - Safe area for dc operation.

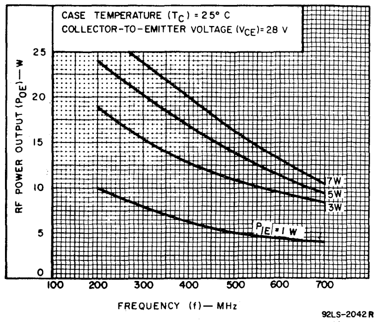


Fig. 3 - Typical power output as a function of frequency.

[a] Pulsed through an inductor (25 mH); duty factor = 50%.

[b] For P_{IE} = 5.0 W; minimum efficiency = 60%.

[c] For P_{IE} = 5.0 W; minimum efficiency = 50%.

*In accordance with JEDEC registration data.

2N5070

Silicon N-P-N Overlay Transistor

For High-Frequency Single-Sideband Communications Equipment

Features:

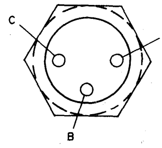
- Suitable for class A or class B amplifiers
- 25 W PEP output min. at 30 MHz with
  gain: 13 dB
  η: 40% min.,
  IMD: 30 dB max.
- Low thermal resistance

MAXIMUM RATINGS, *Absolute-Maximum Values:*

*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	65	V
COLLECTOR-TO-EMITTER VOLTAGE:			
With base-emitter junction reverse-biased (V_{BE}) = -1.5 V	V_{CEV}	65	V
With external base-to-emitter resistance (R_{BE}) = 5Ω	V_{CER}	40	V
* With base open	V_{CEO}	30	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	4	V
*COLLECTOR CURRENT:	I_C		
Continuous		3.3	A
Peak		10	A
*CONTINUOUS BASE CURRENT	I_B	1	A
*TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 25°C		70	W
At case temperatures above 25°C		See Fig. 2	
*TEMPERATURE RANGE:			
Storage and operating (junction)		-65 to 200	°C
*LEAD TEMPERATURE (During soldering):			
At distances ⩾ 1/32 in. (0.8 mm) from insulating wafer for 10 s max.		230	°C

*In accordance with JEDEC registration data

TERMINAL DESIGNATIONS



92CS-27481

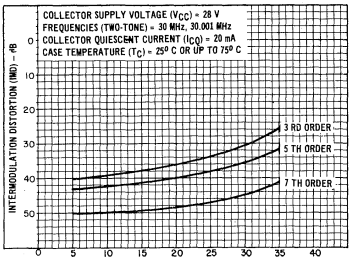
JEDEC TO-60

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25° C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS						LIMITS		UNITS
		VOLTAGE V dc			CURRENT mA dc					
		V_{CB}	V_{CE}	V_{BE}	I_E	I_B	I_C	MIN.	MAX.	
* Collector Cutoff Current: With base-emitter junction reverse-biased	I_{CEV}		60	-1.5				–	10	mA
At T_C = 150° C			60	-1.5				–	10	
With emitter open	I_{CBO}		60		0			–	10	
With base open	I_{CEO}		30			0		–	5	
* Emitter Cutoff Current	I_{EBO}			4				–	10	mA
Collector-to-Emitter Sustaining Voltage: With base-emitter junction reverse-biased	$V_{CEV}(sus)$			-1.5			200[a]	65	–	V
* With base open	$V_{CEO}(sus)$					0	200[a]	30	–	
* With external base-to-emitter resistance (R_{BE}) = 5Ω	$V_{CER}(sus)$						200[a]	40	–	
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$				10			4	–	V
* DC Forward Current Transfer Ratio	h_{FE}		5 5				3000 1000	10 20	100 –	
* Magnitude of Common-Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio (f = 50 MHz)	$\|h_{fe}\|$		15				1000	2	–	
* Output Capacitance (f = 1 MHz)	C_{ob}	30			0			–	85	pF
* Available Amplifier Signal Input Power Z_G = 50Ω, P_o = 25 W(PEP) f_1 = 30 MHz, f_2 = 30.001 MHz	P_i							–	1.25 PEP	W
* Intermodulation Distortion Z_G = 50Ω, P_o = 25 W(PEP) f_1 = 30 MHz, f_2 = 30.001 MHz	IMD							–	30	dB
* Collector Efficiency Z_G = 50Ω, P_o = 25 W(PEP) f_1 = 30 MHz, f_2 = 30.001 MHz	η_C							40	–	%
Thermal Resistance Junction-to-Case	$R_{\theta JC}$							–	2.5	°C/W

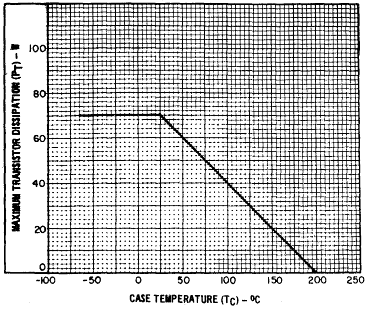
*In accordance with JEDEC registration data format

[a] Pulsed through a 25-mH inductor; duty factor = 50%



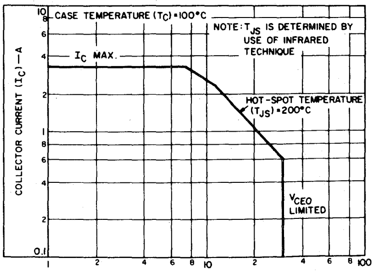
92LS-1877R1

Fig. 1 - Typical intermodulation distortion as a function of rf power output.



92LS-1882R2

Fig. 2 - Dissipation derating chart.



92CS-19139

Fig. 3 - Safe operation with dc forward bias.

2N5071

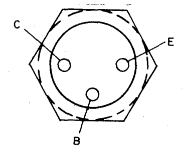
24-W (CW), 76-MHz Emitter-Ballasted Overlay Transistor

Silicon N-P-N Device for 24-Volt Applications in VHF Communications Equipment

Features:

- **For class B or class C amplifiers**
- **For 24-V FM (30 to 76 MHz) communications**
- **24 W output at 76 MHz with 9 dB gain (Min.)**
- **Low thermal resistance**

TERMINAL DESIGNATIONS



92CS-27481

JEDEC TO-60

MAXIMUM RATINGS, *Absolute-Maximum Values:*

*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	65	V
*COLLECTOR-TO-EMITTER VOLTAGE	V_{CEO}	30	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	4	V
*COLLECTOR CURRENT:			
Continuous	I_C	3.3	A
Peak		10	A
*CONTINUOUS BASE CURRENT	I_B	1	A
*TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 25°C		70	W
*TEMPERATURE RANGE:			
Storage and operating (junction)		–65 to 200	°C
*LEAD TEMPERATURE (During soldering):			
At distances ≥ 1/32 in. (0.8 mm) from insulating wafer for 10 s max.		230	°C

ELECTRICAL CHARACTERISTICS, At Case Temperature (T_C) = 25°C

STATIC

CHARACTERISTIC	SYMBOL	TEST CONDITIONS						LIMITS		UNITS
		DC Collector Voltage-V		DC Base Voltage-V	DC Current mA					
		V_{CB}	V_{CE}	V_{BE}	I_E	I_B	I_C	MIN.	MAX.	
* Collector-Cutoff Current:	I_{CEV}		60	−1.5				–	10	mA
At T_C = 150°C			60	−1.5				–	10	
With base open	I_{CEO}		30			0		–	5	
With emitter open	I_{CBO}	60						–	10	
* Emitter-Cutoff Current	I_{EBO}			4				–	10	mA
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$				0		200[a]	65	–	V
* Collector-to-Emitter Breakdown Voltage: With base open	$V_{(BR)CEO}$				0		200[a]	30	–	V
* Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$					0	200[a]	30	–	V
With external base-to-emitter resistance (R_{BE}) = 5 Ω	$V_{CER}(sus)$						200[a]	40	–	
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$					10	0	4	–	V
* DC Forward Current Transfer Ratio	h_{FE}		5				3 A	10	100	
			5				1 A	20	–	
Thermal Resistance (Junction-to-Case)	$R_{\theta JC}$							–	2.5	°C/W

[a] Pulsed through a 25-mH inductor; duty factor = 50%; repetition rate ≥ 60 Hz.

DYNAMIC

CHARACTERISTIC	SYMBOL	TEST CONDITIONS			LIMITS		UNITS
		DC Collector Supply (V_{CC})–V	Input Power (P_{IE})–W	Frequency (f) - MHz	MIN.	MAX.	
Power Output	P_{OE}	24	3	76	24	–	W
Power Gain	G_{PE}	24	3	76	9	–	dB
* Magnitude of Common-Emitter, Small-Signal, Short-Circuit Forward Current Transfer Ratio	$\|h_{fe}\|$	V_{CE} = 15 V I_C = 1 A		50	2	–	
* Available Amplifier Signal Input Power	P_i	Source impedance (Zg) = 50	P_{OE} = 24 W	76	–	3	W
* Collector Efficiency	η_C	24	3	76	60	–	%
Load Mismatch	LM	24	1.2	30	GO/NO GO VSWR = 3:1		
* Collector-to-Base Capacitance	C_{obo}	V_{CB} = 30 V	–	1	–	85	pF

* In accordance with JEDEC registration data

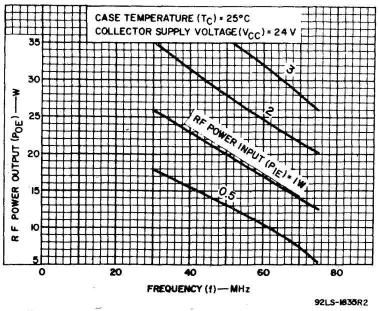


Fig. 1 - Typical output power as a function of frequency.

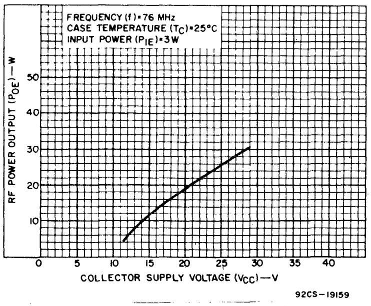


Fig. 2 - Typical output power as a function of collector supply voltage.

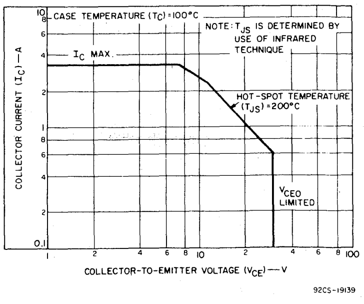


Fig. 3 - Safe area for dc operation.

2N5090

High-Power Silicon N-P-N Overlay Transistor

High-Gain Type for Class A, B, or C Operation in VHF/UHF Circuits

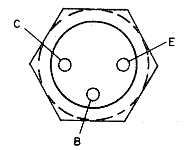
Features:

- Maximum safe-area-of-operation curve
- 1.2 W (min.) output at 400 MHz (7.8 dB gain)
- 1.6 W (typ.) output at 175 MHz (12 dB gain)
- Hermetic stud-type package
- All electrodes isolated from stud

MAXIMUM RATINGS, *Absolute-Maximum Values:*

*COLLECTOR-TO-BASE VOLTAGE .. V_{CBO} 55 V
COLLECTOR-TO-EMITTER VOLTAGE:
With external base-to-emitter resistance, R_{BE} = 10Ω .... V_{CER} 55 V
* With base open .... V_{CEO} 30 V
*EMITTER-TO-BASE VOLTAGE .... V_{EBO} 3.5 V
*CONTINUOUS COLLECTOR CURRENT .... I_C 0.4 A
*CONTINUOUS BASE CURRENT..... I_B 0.4 A
*TRANSISTOR DISSIPATION ...... P_T
At case temperatures up to 100°C........... 4 W
At case temperatures above 100°C. . Derate linearly at 0.04 W/°C
*TEMPERATURE RANGE:
Storage & Operating (Junction)............ −65 to +200 °C
*LEAD TEMPERATURE (During soldering):
At distances ≥ 1/16 in. (1.58 mm) from insulating wafer for 10 s max. .... 230 °C

TERMINAL DESIGNATIONS



JEDEC TO-60

ELECTRICAL CHARACTERISTICS, At Case Temperature (T_C) = 25°C

STATIC

CHARACTERISTIC	SYMBOL	TEST CONDITIONS					LIMITS		UNITS
		DC Collector Voltage-V	DC Base Voltage-V	DC Current mA					
		V_{CE}	V_{BE}	I_E	I_B	I_C	MIN.	MAX.	
* Collector-Cutoff Current: With base open	I_{CEO}	28			0		–	0.02	mA
With base-emitter junction reverse-biased	I_{CEV}	55	−1.5				–	0.1	
With base-emitter junction reverse-biased & T_C = 200°C		30	−1.5				–	5	
* Emitter-Cutoff Current	I_{EBO}		3.5				–	0.1	mA
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$			0		0.1	55	–	V
* Collector-to-Emitter Sustaining Voltage: With base-open	$V_{CEO}(sus)$				0	5	30	–	V
With external base-to-emitter resistance (R_{BE}) = 10Ω	$V_{CER}(sus)$					5	55[a]	–	
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$			0.1		0	3.5	–	V
* Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$				20	100	–	1.0	V
* DC Forward-Current Transfer Ratio	h_{FE}	5 5				360 50	5 10	– 200	
Thermal Resistance (Junction-to-Case)	$R_{\theta JC}$						–	25	°C/W

[a] Pulsed through a 25-mH inductor; duty factor = 0.05%.

DYNAMIC

CHARACTERISTIC	SYMBOL	TEST CONDITIONS					LIMITS		UNITS
		DC Collector Voltage V	Output Power (P_{OE}) W	Input Power (P_{IE}) W	Collector Current (I_C) mA	Frequency (f) MHz	MIN.	MAX.	
Power Output (Class C amplifier, unneutralized)	P_{OE}	V_{CC} = 28		0.2		400	1.2	–	W
Gain-Bandwidth Product	f_T	V_{CE} = 15			50		500	–	MHz
* Magnitude of Common Emitter, Small-Signal, Short-Circuit Forward-Current Transfer Ratio	$\|h_{fe}\|$	V_{CE} = 15			50		2.5	–	
* Available Amplifier Signal Input Power	P_i		1.2			400	–	0.2	W
* Collector Efficiency	η_C		1.2				45	–	%
* Collector-to-Base Capacitance	C_{obo}	V_{CB} = 30				1	–	3.5	pF

*In accordance with JEDEC registration data format JS-6 RDF-3.

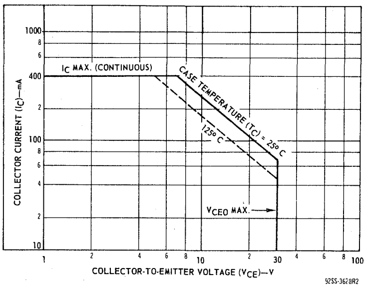


Fig. 1 - Safe area for dc operation.

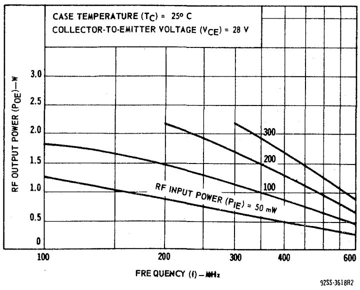


Fig. 2 - Typical output power as a function of frequency.

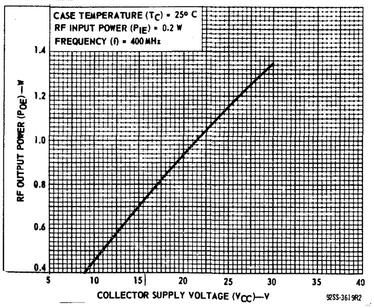


Fig. 3 - Typical output power as a function of collector supply voltage.

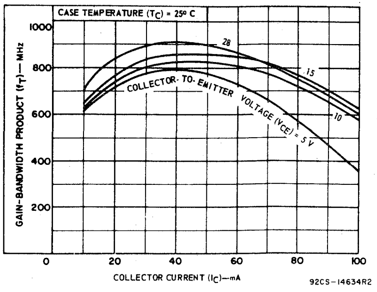


Fig. 4 - Typical gain-bandwidth product as a function of collector current.

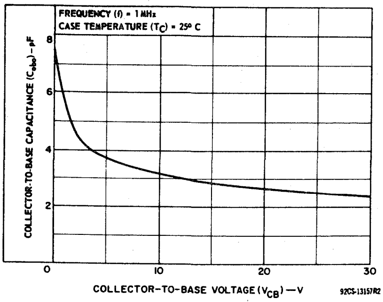


Fig. 5 - Typical variation of collector-to-base capacitance with collector-to-base voltage.

2N5102

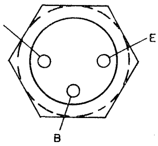
SILICON N-P-N "overlay" TRANSISTOR

High-Power Device for Class-C, AM Operation in VHF Circuits

Features:

- 15 Watts Output Min. at 136 MHz
- For 24-Volt Aircraft Communication
- Complete Load Mismatch Protection
- High Voltage Ratings
- Case Connected to Emitter

TERMINAL DESIGNATIONS



92CS-27481

JEDEC TO-6Q

Maximum Ratings, *Absolute-Maximum Values:*

COLLECTOR-TO-EMITTER VOLTAGE:			
With V_{BE} = − 1.5 volts	V_{CEV}	100	V
With external base-to-emitter resistance R_{BE} = 5 Ω	V_{CER}	50	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	4	V
COLLECTOR CURRENT:			
Peak		10	A
Continuous	I_C	3.3	A
TRANSISTOR DISSIPATION	P_T		
At case temperatures up to 25° C		70	W
TEMPERATURE RANGE:			
Storage & Operating (Junction)		−65 to 200	°C
LEAD TEMPERATURE (During soldering):			
At distances ≥ 1/32 in. from insulating wafer for 10 s max		230	°C

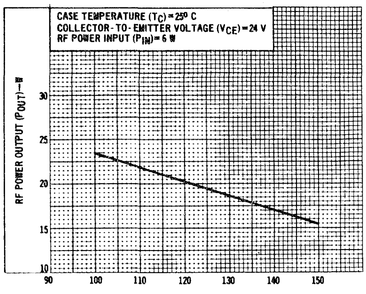
ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS VOLTAGE V dc			CURRENT mA dc			LIMITS		UNITS
		V_{CB}	V_{CE}	V_{BE}	I_E	I_B	I_C	MIN.	MAX.	
* Collector Cutoff Current: With base-emitter junction reverse biased	I_{CEV}		83	−1.5				–	20	mA
* At T_C = 150°C			30	−1.5				–	10	
With external base-to-emitter resistance (R_{BE}) = 5 Ω	I_{CER}		50					–	10	
* Emitter Cutoff Current	I_{EBO}			−4				–	10	mA
* Collector-to-Emitter Sustaining Voltage: With base-emitter junction reverse biased	$V_{CEV}(sus)$			−1.5			600[a]	100	–	V
With external base-to-emitter resistance (R_{BE}) = 5 Ω	$V_{CER}(sus)$						200[a]	50	–	
With base open	$V_{CEO}(sus)$					0	200[a]	35	–	
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$				10		0	4	–	V
* DC Forward Current Transfer Ratio	h_{FE}		4 4				3 A 0.5 A	10 10	– 100	
* Magnitude of Common-Emitter, Small-Signal, Short-Circuit Forward Current Transfer Ratio (f = 150 MHz)	$\|h_{fe}\|$		24				500	1	–	
* Output Capacitance (f = 1 MHz)	C_{ob}	30			0			–	85	pF
* Available Amplifier Signal Input Power[b] (P_O = 15 W, Z_G = 50 Ω, f = 136 MHz)	P_i							–	6	W
* Collector Circuit Efficiency (P_{IE} = 6 W, Z_G = 50 Ω, f = 136 MHz)	η_C							70	–	%
Modulation (f = 118 MHz)	M		24 (V_{CC})					80	–	%
Load Mismatch (f = 118 MHz)	LM		24 (V_{CC})				1100	Will not be damaged		
Dynamic Input Impedance (P_{IE} = 6 W, f = 150 MHz)	Z_{IN}		24 (V_{CC})					1.7 + j 2.6 (typ)		Ω
Thermal Resistance (Junction to Case)	$R_{\theta JC}$							–	2.5	°C/W

* In accordance with JEDEC registration data.

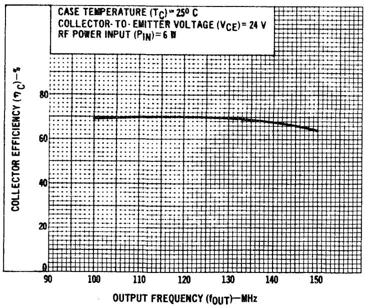
[a] Pulsed through a 9-mH inductor; duty factor = 50%.

[b] Unmodulated carrier.



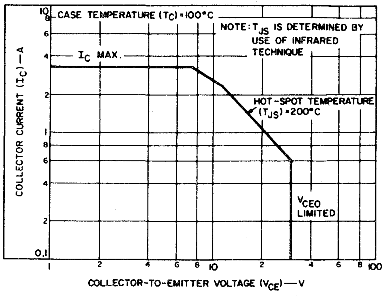
92SS-3664

Fig. 1 - Typical power output as a function of frequency.



92SS-3666

Fig. 2 - Typical collector efficiency as a function of output frequency.



92CS-19139

Fig. 3 - Safe operation area with dc forward bias.

2N5109

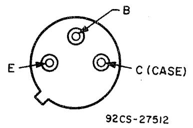
Silicon N-P-N Overlay Transistor

High Gain for Line Amplifiers in CATV and MATV Equipment

Features:

- High gain-bandwidth product
- Large dynamic range
- Low distortion
- Low noise

TERMINAL DESIGNATION



JEDEC TO-39

MAXIMUM RATINGS, *Absolute-Maximum Values:*

* COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	40	V
COLLECTOR-TO-EMITTER VOLTAGE:			
* With base open	V_{CEO}	20	V
With external base-to-emitter resistance (R_{BE}) = 10 Ω	V_{CER}	40	V
* EMITTER-TO-BASE VOLTAGE	V_{EBO}	3	V
* CONTINUOUS COLLECTOR CURRENT	I_C	0.4	A
* CONTINUOUS BASE CURRENT	I_B	0.4	A
* TRANSISTOR DISSIPATION:	P_T		
At case temperature up to 75°C		2.5	W
* TEMPERATURE RANGE:			
Storage and operating (Junction)		-65 to +200	°C
* LEAD TEMPERATURE (During Soldering):			
At distances $\geq$ 1/32 in. (0.8 mm) from the seating plane for 10 s max		230	°C

ELECTRICAL CHARACTERISTICS, Case Temperature (T_C) = 25°C

CHARACTERISTIC	SYMBOL	TEST CONDITIONS							LIMITS		UNITS
		DC COLLECTOR OR BASE VOLTAGE – V				DC CURRENT (mA)					
		V_{CB}	V_{BE}	V_{CE}	V_{EB}	I_E	I_B	I_C	MIN.	MAX.	
Collector-Cutoff Current: With base open	I_{CEO}			15			0		–	20	μA
* With base-emitter junction reverse-biased	I_{CEV}		-1.5	35					–	5	mA
* T_C = 150°C			-1.5	15					–	5	
* Emitter-Cutoff Current	I_{EBO}				3				–	0.1	mA
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$					0		0.1	40	–	V
* Collector-to-Emitter Sustaining Voltage: With external base-to-emitter resistance (R_{BE}) = 10 Ω	$V_{CER}(sus)^a$							5	40	–	V
With base open	$V_{CEO}(sus)$						0	5	20	–	V
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$					0.1		0	3	–	V
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$						10	100	–	0.5	V
* Collector-to-Base Capacitance (f = 1 MHz)	C_{cb}	15				0			–	3.5	pF
* DC Forward-Current Transfer Ratio	h_{FE}			15 5				50 360	40 5	120 –	
Small-Signal Common-Emitter Forward Current Transfer Ratio (f = 200 MHz)	h_{fe}			15 15 15				25 50 100	4.8 6 4.8	– – –	
* Magnitude of Common-Emitter Small-Signal Forward Current Transfer Ratio (f = 200 MHz)	$\|h_{fe}\|$			15				50	6	–	
* Available Amplifier Signal Input Power (P_{out} = 1.26 mW, Source Impedance = 50 Ω, f = 200MHz)	P_i	15 (V_{CC})						50	–	0.1	mW
* Voltage Gain, Wideband, 50 to 216 MHz	G_{VE}			15				50	11		dB
Cross Modulation @ 54 dBmV^b Output	CM			15				50	–57 (typ.)		dB
Power Gain, Narrowband (f = 200 MHz, P_{IN} = -10 dBm)	G_{PE}			15				10	11		dB
Noise Figure (f = 200 MHz)	NF			15				10	3 (typ.)		dB

^{a}Pulsed through a 25 mH inductor; duty factor = 50%

^{b} O dBmV = 1 millivolt

* In accordance with JEDEC registration data

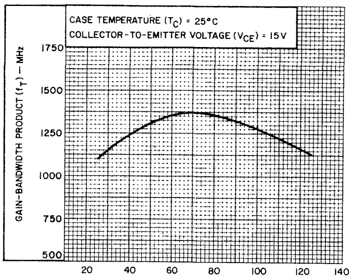


Fig. 1 - Gain-bandwidth product as a function of collector current.

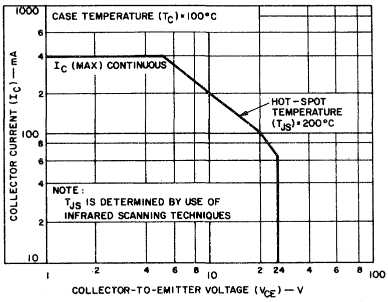


Fig. 2 - Maximum operating area.

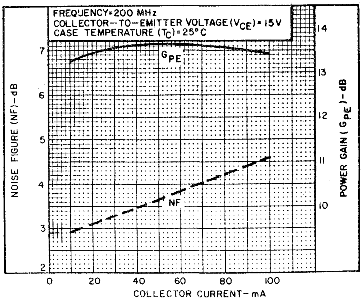


Fig. 3 - Power gain and noise figure as a function of collector current.

2N5179

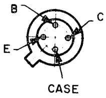
SILICON N-P-N EPITAXIAL PLANAR TRANSISTOR

For UHF Applications in Military, Communications, and Industrial Equipment

Features:

- high gain-bandwidth product — 1000MHz min.
- hermetically sealed TO-72 four-lead metal package
- low leakage current
- high power gain as neutralized amplifier —
  G_{pe} = 15dB min. at 200MHz
- high power output as UHF oscillator —
  20mW typ. at 500MHz
- low noise figure —
  NF = 4.5dB max. at 200MHz
- low collector-to-base time constant —
  $r_b'C_c$ = 14ps max.
- high reliability —
  production lots of RCA-2N5179 are subjected to and meet the minimum mechanical, environmental, and life-test requirements of the basic MILITARY specification MIL-S-19500. See Fig. 2 for a description of the Group A and Group B Tests.

TERMINAL DESIGNATIONS



92CS-27513

JEDEC TO-72

Maximum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE, V_{CBO}	20 max.	V
COLLECTOR-TO-EMITTER VOLTAGE, V_{CEO}	12 max.	V
EMITTER-TO-BASE VOLTAGE, V_{EBO}	2.5 max.	V
COLLECTOR CURRENT, I_C	50 max.	mA
TRANSISTOR DISSIPATION, P_T:		
For operation with heat sink:		
At case temperatures** up to 25°C	300 max.	mW
At case temperatures** above 25°C	Derate at 1.71mW/°C	
For operation at ambient temperatures:		
At ambient temperatures up to 25°C	200 max.	mW
At ambient temperatures above 25°C	Derate at 1.14mW/°C	
TEMPERATURE RANGE:		
Storage and Operating (Junction)	−65 to +200	°C
LEAD TEMPERATURE (During Soldering):		
At distances ≥ 1/32″ from seating surface for 10 seconds max.	265 max.	°C

** Measured at center of seating surface.

ELECTRICAL CHARACTERISTICS

Characteristics	Symbols	TEST CONDITIONS								LIMITS			Units
		Ambient Temp. T_A	Frequency f	DC Collector-to-Base Voltage V_{CB}	DC Collector-to-Emitter Voltage V_{CE}	DC Emitter-to-Base Voltage V_{EB}	DC Emitter Current I_E	DC Collector Current I_C	DC Base Current I_B	Type 2N5179			
		°C	MHz	V	V	V	mA	mA	mA	Min.	Typ.	Max.	
Collector-Cutoff Current	I_{CBO}	25 150		15 15			0 0			- -	- -	0.02 1	μA μA
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$	25					0	0.001		20	-	-	V
Collector-to-Emitter Sustaining Voltage	$V_{CEO}(sus)$	25						3	0	12	-	-	V
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$	25					−0.01	0		2.5	-	-	V
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$	25						10	1	-	-	0.4	V
Base-to-Emitter Saturation Voltage	$V_{BE}(sat)$	25						10	1	-	-	1	V
Static Forward Current-Transfer Ratio	h_{FE}	25			1			3		25	70	250	
Magnitude of Small-Signal Forward Current-Transfer Ratio[a]	$\|h_{fe}\|$	25	100 1 kHz		6 6			5 2		9 25	14 90	20 300	
Collector-to-Base Feedback Capacitance[b]	C_{cb}	25	0.1 to 1	10			0			-	0.7	1	pF
Common-Base Input Capacitance[c]	C_{ib}	25	0.1 to 1			0.5		0		-	-	2	pF
Collector-to-Base Time Constant[a]	$r_b'C_c$	25	31.9	6				2		3	7	14	ps
Small-Signal Power Gain in Neutralized Common-Emitter Amplifier Circuit[a]	G_{pe}	25	200		12			5		15	21	-	dB
Power Output in Common-Emitter Oscilator Circuit[c]	P_o	25	>500	10			−12			20	-	-	mW
Noise Figure[a]	NF	25	200		6			1.5		-	3	4.5	dB

[a] Lead No.4(case) grounded; Rg = 125Ω

[b] *Three-terminal measurement of the collector-to-base capacitance with the case and emitter leads connected to the guard terminal.*

[c] Lead No. 4 (case) floating.

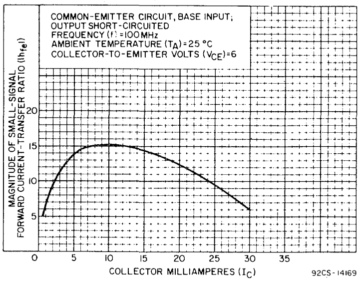
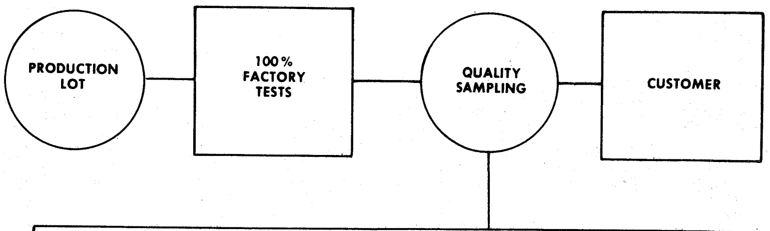


Fig. 1-Small-signal beta characteristics for type 2N5179.



ITEM	TEST DESCRIPTION	LTPD
GROUP A TESTS		
Subgroup 1.	Visual and Mechanical Examination	5%
Subgroup 2.	Electrical	10%
GROUP B TESTS		
Subgroup 1.	Physical Dimensions	20%
Subgroup 2.	Solderability, Temperature Cycling, Thermal Shock, Moisture Resistance	20%
Subgroup 3.	Shock, Vibration Fatigue, Vibration Variable Frequency, Constant Acceleration	20%
Subgroup 4.	Terminal Strength	20%
Subgroup 5.	Salt Atmosphere	20%
Subgroup 6.	High-Temperature Life, Non-Operating (T_A = 200°C)	λ = 10%
Subgroup 7.	Steady-State-Operation Life (P_D = 300mW, T_A = 25°C)	λ = 10%

Fig. 2 - Group A and Group B Quality Sampling Tests.

2N5180

Silicon N-P-N Epitaxial Planar Transistor

For VHF Applications in Industrial and Commercial Equipment

Features:

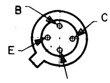
- High gain-bandwidth product
- Low noise figure
- High unneutralized power gain
- Hermetically sealed four-lead metal package
- All active elements insulated from case
- Low collector-to-base feedback

MAXIMUM RATINGS, *Absolute-Maximum Values:*

*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	30	V
*COLLECTOR-TO-EMITTER VOLTAGE	V_{CEO}	15	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	2	V
*CONTINUOUS COLLECTOR CURRENT	I_C	limited by dissipation	
*TRANSISTOR DISSIPATION:	P_T		
At ambient temperatures up to 25°C		180	mW
At ambient temperatures above 25°C		See Fig.2	
*TEMPERATURE RANGE:			
Storage & Operating (Junction)		–65 to 175	°C
*LEAD TEMPERATURE (During Soldering):			
At distances ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max.		265	°C

* Measured at center of seating surface.

TERMINAL DESIGNATIONS



92CS-27513

JEDEC TO-72

ELECTRICAL CHARACTERISTICS, at T_A = 25°C

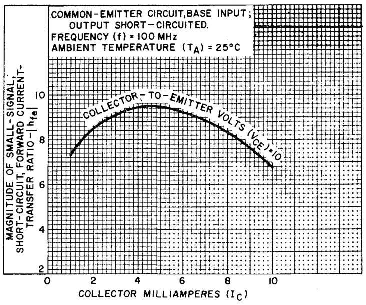
Characteristics	Symbols	TEST CONDITIONS					LIMITS			Units
		Frequency f	DC Collector-to-Base Voltage V_{CB}	DC Collector-to-Emitter Voltage V_{CE}	DC Emitter Current I_E	DC Collector Current I_C	Type 2N5180			
		MHz	V	V	mA	mA	Min.	Typ.	Max.	
* Collector-Cutoff Current	I_{CBO}		8		0				0.5	μA
* Collector-to-Base Breakdown Voltage	BV_{CBO}				0	0.001	30			V
* Collector-to-Emitter Breakdown Voltage	BV_{CEO}					0.001	15			V
* Emitter-to-Base Breakdown Voltage	BV_{EBO}				-0.001	0	2			V
* Static Forward-Current Transfer Ratio	h_{FE}			8		2	20		200	
* Magnitude of Small-Signal Forward-Current Transfer Ratio	$\|h_{fe}\|^a$	100		8		2	6.5	9	17	
* Collector-to-Base Feedback Capacitance	C_{cb}^b	0.1 to 1	8		0				1	pF
* Small-Signal, Common-Emitter Power Gain in Unneutralized Amplifier Circuit	G_{PE}^a	200		10		2	12		19	dB
VHF Noise Figure	NF^a $NF^{a,c}$	200 60		8 8		2 1		 2.5	4.5	dB dB
* Collector-Base Time Constant	$r_b'C_c$	31.9	8		-2		2	–	16	ps
* Real Part of Common-Emitter Small-Signal Short-Circuit Input Impedance	$R_a(h_{ie})$	200		10		2	60	–	240	Ω
* Bandwidth	BW	200		10		2	650	–	1700	MHz

[a] Fourth lead (case) grounded.

[b] C_{cb} is a three terminal measurement of the collector-to-base capacitance with the emitter and case connected to the guard terminal.

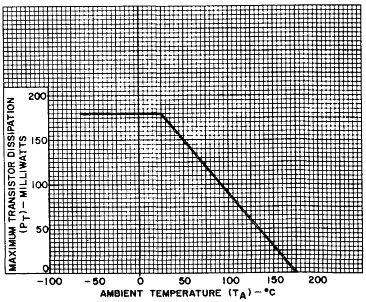
[c] Source Resistance, R_s=400 ohms.

* In accordance with JEDEC registration data format JS-9 RDF-1.



92CS-14785

Fig. 1 - Typical small-signal beta characteristics for 2N5180.



92CS 14777

Fig. 2 - Rating chart for 2N5180.

2N5913

Silicon N-P-N Overlay Transistor

12.5-Volt, High-Gain Type for Class-C Amplifiers in VHF/UHF Communications Equipment

Features:

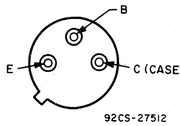
- High Power Gain, High Power Output . . .
  At 12.5 V:
    2-W (typ.) output at 470 MHz (7-dB gain)
    2-W (typ.) output at 250 MHz (9-dB gain)
    2-W (typ.) output at 175 MHz (13-dB gain)
  At 8 V:
    1.5-W (typ.) output at 470 MHz (4.8-dB gain)
    1.5-W (typ.) output at 250 MHz (7.0-dB gain)
    1.5-W (typ.) output at 175 MHz (10-dB gain)

MAXIMUM RATINGS, ***Absolute-Maximum Values:***

*COLLECTOR-TO-BASE VOLTAGE.	V_{CBO}	36	V
COLLECTOR-TO-EMITTER BREAKDOWN VOLTAGE:			
With base shorted to emitter	$V_{(BR)CES}$	36	V
*With base open	$V_{(BR)CEO}$	14	V
*EMITTER-TO-BASE VOLTAGE . . .	V_{EBO}	3.5	V
*CONTINUOUS COLLECTOR CURRENT.	I_C	0.33	A

*TRANSISTOR DISSIPATION: . . . . . P_T		
At case temperatures up to 75°C. .	3.5	W
At case temperatures above 75°C .	Derate at 0.0028 W/°C	
*TEMPERATURE RANGE:		
Storage & Operating (Junction) . .	-65 to +200	°C
*LEAD TEMPERATURE:		
At distances ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max. .	230	°C

TERMINAL DESIGNATIONS



JEDEC TO-39

ELECTRICAL CHARACTERISTICS *Case Temperature (T_C) = 25°C Unless Otherwise Specified*

STATIC

CHARACTERISTIC	SYMBOL	TEST CONDITIONS					LIMITS		UNITS
		DC Voltage (V)		DC Current (mA)					
		V_{CE}	V_{EB}	I_E	I_B	I_C	Min.	Max.	
* Collector-Cutoff Current Base Connected to Emitter	I_{CES}	12.5			0			1.0^b	mA
Base Open	I_{CEO}	10			0			0.3	mA
* Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$			0		0.5	36	-	V
* Collector-to-Emitter Breakdown Voltage: With base open	$V_{(BR)CEO}$				0	25^a	14	-	V
With base connected to emitter	$V_{(BR)CES}$		0			25^a	36	-	
* Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$			0.5		0	3.5	-	V
Thermal Resistance: (Junction-to-Case).	$\theta_{J\text{-}C}$						-	35.7	°C/W

[a] Pulsed through a 25-mH inductor; duty factor ~ 50%.

[b] T_C = 100°C.

DYNAMIC

TEST & CONDITIONS	SYMBOL	FREQUENCY MHz	LIMITS		UNITS
			MINIMUM	TYPICAL	
Power Output (V_{CC} = 12.5 V): P_{IE} - 0.1 W	P_{OE}	175	1.75		W
* Large-Signal Common-Emitter Power Gain (V_{CC} = 12.5 V): P_{IE} = 0.1 W	G_{PE}	175	12.4		dB
* Collector Efficiency (V_{CC} = 12.5 V): P_{IE} = 0.1 W	η_C	175	50		%
* Common-Base Output Capicatance V_{CB} = 12 V	C_{obo}	1	15 (max.)		pF

* In accordance with JEDEC registration data format JS-6 RDF-3/JS-9 RDF-7.

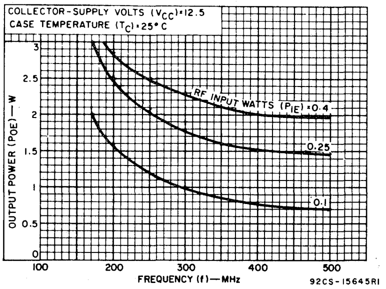


Fig. 1 - Typical power output as a function of frequency.

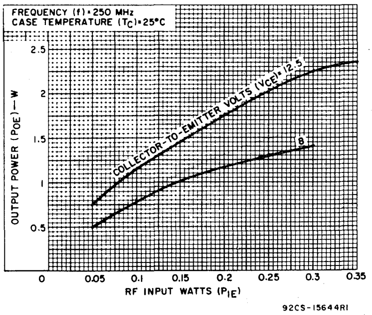


Fig. 2 - Typical power output as a function of power input at 250 MHz.

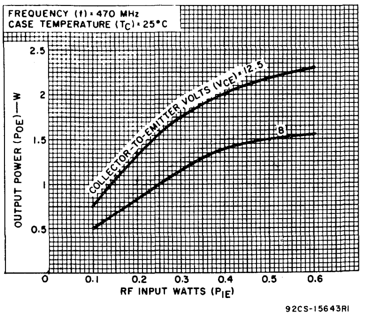


Fig. 3 - Typical power output as a function of power input at 470 MHz.

2N6389

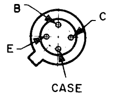
UHF/MATV Low-Noise Silicon N-P-N Transistor

For High-Gain Small-Signal Applications in UHF TV
RF Amplifiers and UHF MATV Amplifiers

Features:

- **Low noise figure:**
  NF = 3 dB (typ.) at 450 MHz, 1.5 mA
  = 4 dB (typ.) at 890 MHz, 1.5 mA
  = 6 dB (typ.) at 890 MHz, 10 mA
- **High gain (tuned, unneutralized):**
  G_{PE} = 15 dB (min.) at 890 MHz
- **High gain-bandwidth product**
- **Large dynamic range**
- **Low distortion**
- **Low collector-base capacitance**

TERMINAL DESIGNATION



CASE

92CS-27513

JEDEC TO-72

MAXIMUM RATINGS, *Absolute-Maximum Values:*

*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	20	V
*COLLECTOR-TO-EMITTER VOLTAGE	V_{CEO}	12	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	2.5	V
*COLLECTOR CURRENT (Continuous)	I_C	40	mA
*TRANSISTOR DISSIPATION:	P_T		
At ambient temperatures up to 25°C		200	mW
At ambient temperatures above 25°C		Derate linearly at 1.14 mW/°C	
*TEMPERATURE RANGE:			
Storage and Operating (Junction)		−65 to +200° C	
*LEAD TEMPERATURE (During soldering):			
At distances ≥ 1/16 in. (1.59 mm) from seating plane for 60 s max.		300° C	

ELECTRICAL CHARACTERISTICS, *At Ambient Temperature (T_A) = 25°C*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS					LIMITS		UNITS
		VOLTAGE V dc		CURRENT mA dc					
		V_{CB}	V_{CE}	I_E	I_B	I_C	MIN.	MAX.	
STATIC									
* Collector Cutoff Current	I_{CBO}	15		0				20	nA
* Emitter Cutoff Current	I_{EBO}	(V_{EB}) 1				0		1	µA
* Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$			0		0.001	20		V
* Collector-to-Emitter Breakdown Voltage	$V_{(BR)CEO}$				0	3	12		V
* Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$			0.01		0	2.5		V
* DC Forward Current Transfer Ratio	h_{FE}		1			3	25	250	
Thermal Resistance: (Junction-to-Case)	$R_{\theta JC}$							880	°C/W
DYNAMIC									
Device Noise Figure: f = 890 MHz = 890 MHz = 450 MHz	NF	10 10 10				1.5 10 1.5		4(typ.) 6(typ.) 3(typ.)	dB
Small-Signal Common-Base Power Gain (f = 890 MHz)	G_{PB}	10				10	15		dB
* Small-Signal, Short Circuit Forward Current Transfer Ratio (f = 1 kHz)	h_{fe}		1			3	25	250	
* Magnitude of Small-Signal Short Circuit Forward Current Transfer Ratio (f = 200 MHz)	$\|h_{fe}\|$		10			1.5	5	15	
* Collector-to-Base Time Constant (f = 31.9 MHz)	$r_b'C_c$	10		1.5			1	15	ps
* Collector-to-Base Capacitance (f = 1 MHz)	C_{cb}	10		0			0.4	0.55	pF

* In accordance with JEDEC registration data format JS-9 RDF-1.

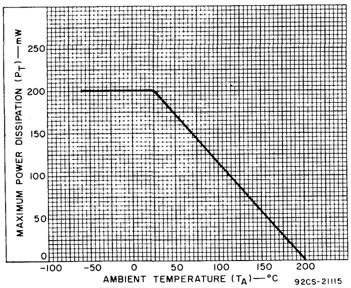


Fig. 1 - Power dissipation as a function of ambient temperature.

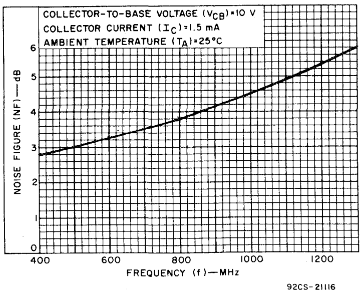


Fig. 2 - Typical common-base noise figure as a function of frequency.

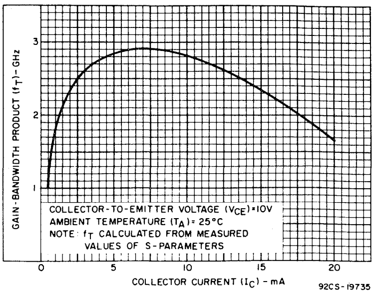


Fig. 3 - Gain-bandwidth product as a function of collector current.

40080, 40446, 40581, 40582

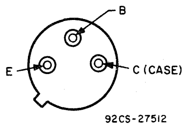
Silicon N-P-N Planar Transistors

For Class C Operation in 27-MHz "CB" Circuits

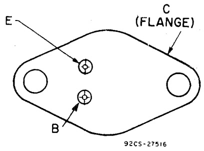
Features:

- OSCILLATOR: 40080 (TO-5)
- OUTPUT: 40581 (TO-39)
  40446, 40582 (TO-39 + Flange)

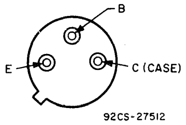
TERMINAL DESIGNATION



40581
JEDEC TO-39



40582
40446
JEDEC TO-39
(FLANGE)



40080
JEDEC TO-5

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		40080	40581	40446 40582	
COLLECTOR-TO-EMITTER VOLTAGE:					
With V_{BE} = –0.5 volts	V_{CEV}	–	60	60	V
With base open	V_{CEO}	30	–	–	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	–	2.5	2.5	V
PEAK COLLECTOR CURRENT		0.25	1.5	1.5	A
TRANSISTOR DISSIPATION:	P_T				
At case temperatures up to 25°C		–	5.0	10	W
At free-air temperatures up to 25°C		0.5	–	–	W
At case temperatures above 25°C		← See Fig. 1 →			
TEMPERATURE RANGE:					
Storage & Operating (Junction)		← –65 to 200 →			°C
LEAD TEMPERATURE (During soldering):					
At distances ⩾ 1/32 in. (0.8 mm) from insulating wafer for 10s max		← 230 →			°C

ELECTRICAL CHARACTERISTICS, *Case Temperature (T_C) = 25°C*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS							LIMITS				UNITS
		DC COLLECTOR VOLTAGE V			DC EMITTER OR BASE VOLTAGE V	DC CURRENT mA			40080		40581 40582 40446		
		V_{CB}	V_{CE}	V_{CC}	V_{BE}	I_C	I_E	I_B	MIN.	MAX.	MIN.	MAX.	
Collector-to-Emitter Voltage:	V_{CEO}					10		0	30	–	–	–	V
	V_{CEV}				-0.5 -0.5	100μA 500μA			–	–	60	–	V
Emitter-to-Base Voltage:	V_{EBO}					0 0	500μA 500μA		–	–	2.5	–	V
Collector-Cutoff Current	I_{CBO}	15 15 15					0 0 0		–	10	–	10	μA
Collector-to Base Capacitance: (Measured at 1 MHz)	C_{ob}		30 30 30							6		20	pF
RF Power Output: Oscillator (f = 27 MHz) P_{IN} = 75 mW)	P_{OUT}			12		32			100		–	–	mW
Output Amplifier (f = 27 MHz, P_{IN} = 350 mW)	P_{OUT}			12		415					3.0 (min.) 40446		W
				12		450					3.5 (min.) [40581, 40582]		
Junction-to-Case Thermal Resistance:	$R_{\theta JC}$								350[a] (max.)		17.5 (max.) [40446, 40582] 35 (max.) 40581		°C/W

[a] Junction-to-Ambient Thermal Resistance, $R_{\theta JA}$

TYPICAL C.B. TRANSMITTER PERFORMANCE (V_{CC} = 13.8 V)

STAGE	RCA TYPE	NO MODULATION		100% MODULATION	
		I_C mA	RF P_{OUT} W	I_C mA	RF P_{OUT} W
Oscillator	40080	15	–	15	–
Output	40581 40446, or 40582	330	3.5[a]	330	4.8 (typ.)

[a] Adjusted for maximum legal power output.

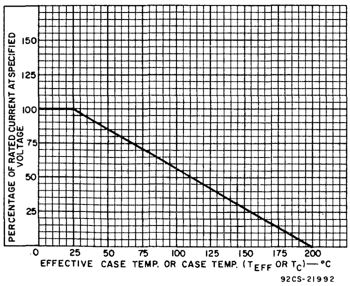


Fig. I - Dissipation derating curves.

40280-40282

1,4,&12-W, 175-MHz Overlay Transistors

Silicon N-P-N Devices for High-Power VHF Amplifier Service

Features:

- **Suitable for low-voltage supplies (13.5 V)**
- **High output power at 175 MHz, unneutralized class C amplifier**
- **High efficiency at 175 MHz**
- **Low input impedance**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		40280	40281	40282	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	36	36	36	V
COLLECTOR-TO-EMITTER VOLTAGE:					
With base open	V_{CEO}	18	18	18	V
With V_{BE} = −1.5V	V_{CEV}	36	36	36	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	4	4	4	V
COLLECTOR CURRENT	I_C	0.5	1	2	A

TRANSISTOR DISSIPATION P_T				
At case temperatures up to 25°C	7.0	11.6	23.2	W
At case temperatures above 25°C	Derate linearly to 0 watts at 200°C			
TEMPERATURE RANGE:				
Storage & Operating (Junction)	−65 to 200			°C
LEAD TEMPERATURE (During soldering):				
At distances ≥1/32 in. (0.8 mm) from insulating wafer (TO-60) package or from seating plane (TO-39 package) for 10 s max.	230			°C

ELECTRICAL CHARACTERISTICS *At Case Temperature (T_C) = 25 °C*

Characteristics	Symbol	TEST CONDITIONS						LIMITS						Units
		DC Collector Volts		DC Base Volts	DC Current (Milliamperes)			Type 40280		Type 40281		Type 40282		
		V_{CB}	V_{CE}	V_{BE}	I_E	I_B	I_C	Min.	Max.	Min.	Max.	Min.	Max.	
Collector Cutoff Current	I_{CEO}		15			0		–	100	–	100	–	250	μA
Collector-to-Base Breakdown Voltage	BV_{CBO}				0 0		0.25 0.50	36 –	– –	36 –	– –	– 36	– –	V V
Emitter-to-Base Breakdown Voltage	BV_{EBO}				0.10 0.25		0 0	4 –	– –	4 –	– –	– 4	– –	V V
Collector-to-Emitter Breakdown Voltage	BV_{CEV}			−1.5			200[a]	36	–	36	–	36	–	V
Collector-to-Emitter Sustaining Voltage	$V_{CEO}(sus)$					0	200[a]	18	–	18	–	18	–	V
Real Part of Common-Emitter High Frequency Input Impedance (At f = 175 MHz)	hie (real)		13.5 13.5 13.5				100 400 800	10 (typ.) – –	 – –	– 7 (typ.) –	– –	– – 5 (typ.)	– – 	Ω Ω Ω
RF Power Output: As Class-C Amplifier, Unneutralized (At f = 175 MHz)	P_{OUT}		13.5					1[b]	–	4[c]	–	12[b]	–	W
Gain-Bandwidth Product	f_T		13.5 13.5 13.5				100 400 800	550 (typ.) – –	 – –	– 400 (typ.) –	– –	– – 350 (typ.)	– – 	MHz MHz MHz
Collector-to-Base Capacitance (At f = 1 MHz)	C_{ob}	13.5			0			–	15	–	22	–	45	pF
Collector-to-Case Capacitance	C_s							–	–	–	5	–	5	pF
Thermal Resistance Junction-to-Case	ΘJ-C							–	25	–	15	–	7.5	°C/W

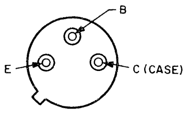
[a] Pulsed through an inductor (25 mH); duty factor = 50%.

[b] For P_{IN} = 0.125 w; minimum efficiency = 60%.

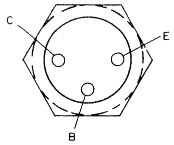
[c] For P_{IN} = 1.0 W; minimum efficiency = 70%.

[d] For P_{IN} = 4.0 W; minimum efficiency = 80%.

TERMINAL DESIGNATIONS



40280
JEDEC TO-39



40281, 40282
JEDEC TO-60

TYPICAL RF POWER OUTPUT vs. RF POWER INPUT
175-MHz Operation

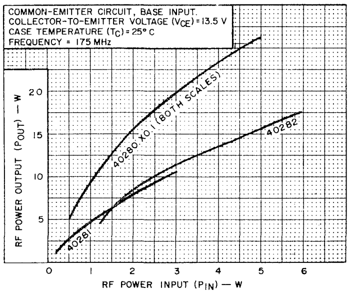


Fig. 1

40290-40292

SILICON N-P-N "overlay" TRANSISTORS

For Low Supply Voltage, High Power Output, Amplitude Modulated, VHF Class-C Amplifier Service in Aircraft, Military, and Industrial Communications Equipment

Features:

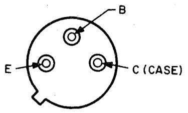
- High carrier output power as 135 Mc Class-C amplifier with 12.5 volt collector supply voltage
  40290 — 2 watts (min.) at P_{IN} = 0.5 watt
  40291 — 2 watts (min.) at P_{IN} = 0.5 watt
  40292 — 6 watts (min.) at P_{IN} = 2.0 watts
- 100% testing of all transistors performed to assure excellent upward modulation characteristics
- High collector efficiency at 135 Mc
- All electrodes isolated from case (40291 and 40292)

Maximum Ratings, *Absolute-Maximum Values:*

	40290	40291	40292	
COLLECTOR-TO-EMITTER VOLTAGE:				
With V_{BE} = -1.5 volts, V_{CEX}	50	50	50	volts
At f = 100 Mc, V_{CEV}(RF).	90	90	90	volts
EMITTER-TO-BASE VOLTAGE, V_{EBO}	4	4	4	volts
COLLECTOR CURRENT, I_C . .	0.5	0.5	1.25	amperes
TRANSISTOR DISSIPATION, P_T:				
At case temperatures up to 25° C.	7.0	11.6	23.2	watts
At case temperatures above 25° C.	Derate linearly to 0 watts at 200° C			

	40290 40291 40292	
TEMPERATURE RANGE:		
Storage.	-65 to 200°C	
Operating (Junction) .	-65 to 200°C	
PIN OR LEAD TEMPERATURE (During soldering): At distances ≥ 1/32 from insulating wafer (TO-60 package) or from seating plane (TO-39 package) for 10 seconds maximum .	230	°C

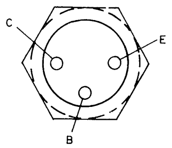
TERMINAL DESIGNATIONS



92CS-27512

40290

JEDEC TO-39



92CS-27481

40291,40292

JEDEC TO-60

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS						LIMITS						UNITS
		DC Collector Volts		DC Base Volts	DC Current (Milliamperes)			Type 40290		Type 40291		Type 40292		
		V_{CB}	V_{CE}	V_{BE}	I_E	I_B	I_C	Min.	Max.	Min.	Max.	Min.	Max.	
Collector Cutoff Current	I_{CEO}		15			0		–	100	–	100	–	250	μa
Emitter-to-Base Breakdown Voltage	BV_{EBO}				0.1 0.25		0 0	4.0 –	– –	4.0 –	– –	– 4.0	– –	Volts Volts
Collector-to-Emitter Breakdown Voltage	BV_{CEX}			–1.5			200[a]	50	–	50	–	50	–	Volts
Real Part of Common-Emitter Input Impedance (At f = 135 Mc)	$hie_{(real)}$		12.5 12.5				100 400	12(Typ.) –	 –	12(Typ.) –	 –	– 6.5(Typ.)	– 	ohms ohms
RF Carrier Power Output: As Class-C Amplifier, (At f = 135 Mc)	P_{OUT}		12.5					2.0[c]	–	2.0[c]	–	6.0[d]	–	watts
Gain-Bandwidth Product	f_T		12.5 12.5				100 400	500(Typ.) –	 –	500(Typ.) –	 –	– 300(Typ.)	– 	Mc Mc
Collector-to-Base Capacitance (At f = 1 Mc)	C_{ob}	12.5			0			–	17	–	17	–	30	pf
Collector-to-Case Capacitance	C_s							–	–	–	6.0	–	6.0	pf
Thermal Resistance (Junction-to-Case)	$\theta_{J\text{-}C}$							–	25	–	15	–	7.5	°C/W

[a] Pulsed through an inductor (25 mh); R_{BE} = 39 ohms; duty factor = 50%.

[b] At frequencies of 100 Mc or higher.

[c] For P_{IN} = 0.5 w; minimum efficiency = 70%.

[d] For P_{IN} = 2.0 w; minimum efficiency = 70%.

40340, 40341

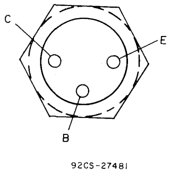
High-Power 50-MHz Emitter-Ballasted Silicon N-P-N Overlay Transistors

For 13.5-V and 24-V Applications in Mobile Communications Equipment

Features:

- Emitter ballasting resistors
- 13.5 V–25 W min. power output, 7 dB min. gain (40340)
- 24 V–30 W min. power output, 10 dB min. gain (40341)
- Emitter connected to case
- Infinite load mismatch tested at 50 MHz

TERMINAL DESIGNATIONS



JEDEC TO-60

MAXIMUM RATINGS, *Absolute-Maximum Values:*		40340	40341	
COLLECTOR-TO-EMITTER VOLTAGE:				
With base open	V_{CEO}	25	35	V
With base-emitter junction reverse-biased (V_{BE}) = −1.5 volts	V_{CEV}	60	70	V
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	60	70	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	4.0	4.0	V
PEAK COLLECTOR CURRENT		10	10	A
CONTINUOUS COLLECTOR CURRENT	I_C	3.3	3.3	A
TRANSISTOR DISSIPATION	P_T			
At case temperatures up to 25°C		70	70	W
TEMPERATURE (Operating junction)	T_J	200	200	°C

ELECTRICAL CHARACTERISTICS, At Case Temperature (T_C) = 25°C

STATIC

CHARACTERISTIC	SYMBOL	TEST CONDITIONS					LIMITS				UNITS
		DC Collector Voltage (V)		DC Base Voltage (V)	DC Current (mA)		40340		40341		
		V_{CB}	V_{CE}	V_{BE}	I_E	I_C	Min.	Max.	Min.	Max.	
Collector-Cutoff Current: With base open	I_{CEO}		30 15				– –	– 1.0	– –	1.0 –	mA
With emitter open	I_{CBO}	50 40					– –	– 10	– –	10 –	
Collector-to-Emitter Breakdown Voltage: With base open	$V_{(BR)CEO}$					200[a]	25	–	35	–	V
With base-emitter junction reverse biased, and external base-to-emitter resistance (R_{BE}) = 20 Ω	$V_{(BR)CEV}$			−1.5		200[a]	60	–	70	–	
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$				10		4	–	4	–	V
Thermal Resistance: (Junction-to-Case)	$R_{\theta JC}$						2.5		2.5		°C/W

[a] Pulsed through a 25-mH inductor; duty factor = 50%.

DYNAMIC

CHARACTERISTIC	SYMBOL	TEST CONDITIONS			LIMITS				UNITS
		DC Collector Supply (V_{CC})–V	Input Power (P_{IE})–W	Frequency (f) - MHz	40340		40341		
					Min.	Max.	Min.	Max.	
Power Output	P_{OE}	13.5 24	5 3	50 50	25 –	– –	– 30	– –	W
Power Gain	G_{PE}	13.5 24	5 3	50 50	7 –	– –	– 10	– –	dB
Collector Efficiency	η_C	13.5 24	5 3	50 50	60 –	– –	– 60	– –	%
Load Mismatch	LM	13.5 24	5 3	50 50	GO/NO GO				
Collector-to-Base Capacitance	C_{obo}	V_{CB} = 30 V_{CB} = 15		1 1	– –	– 120	– –	85 –	pF

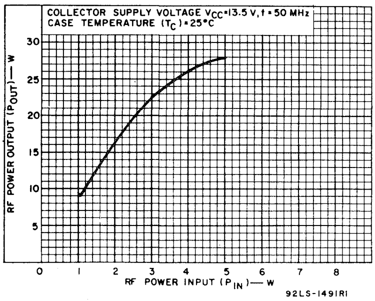


Fig. 1 - Typical performance of type 40340 in a common-emitter amplifier.

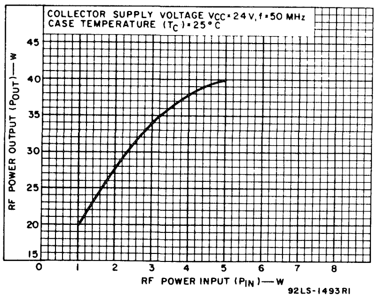


Fig. 2 - Typical performance of type 40341 in a common-emitter amplifier.

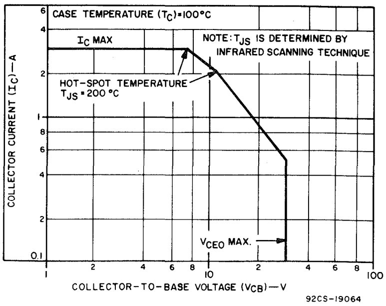


Fig. 3 - Safe area for dc operation.

40608

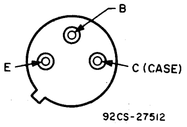
SILICON N-P-N "overlay" TRANSISTOR

For Class A Wide-Band CATV and MATV Applications

Features:

- High Gain-Bandwidth Product
- Low Cross-Modulation

TERMINAL DESIGNATIONS



JEDEC TO-39

MAXIMUM RATINGS, *Absolute-Maximum Values:*

COLLECTOR-TO-BASE VOLTAGE . .	V_{CBO}	40	V
COLLECTOR-TO-EMITTER VOLTAGE: With external base-to-emitter resistance, (R_{BE}) = 100Ω	V_{CER}	40	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	2	V
COLLECTOR CURRENT	I_C	0.4	A
TRANSISTOR DISSIPATION	P_T		
At case temperatures up to 25°C		3.5	W
At case temperatures above 25°C.		See *Fig. 1.*	
TEMPERATURE RANGE:			
Storage & Operating (Junction).		-65 to +200	°C
LEAD TEMPERATURE (During soldering):			
At distances ≥ 1/32 in. (0.79 mm) from seating plane for 10 s max.		230	°C

ELECTRICAL CHARACTERISTICS, ***Case Temperature = 25° C***

Characteristic	Symbol	Test Conditions					Limits		Units
		DC Collector Volts		DC Current (mA)					
		V_{CB}	V_{CE}	I_E	I_B	I_C	Min.	Max.	
Collector-Cutoff Current	I_{CEO}		20		0			100	µA
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$			0		0.1	40		V
Collector-to-Emitter Voltage (Sustaining)	$V_{CER}(sus)$					50[a]	40		V
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$			0.1		0	2		V
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$				10	50		1.0	V
Collector-to-Base Capacitance (Measured at 1MHz)	C_{ob}	30		0				3.0	pF
Gain-Bandwidth Product	f_T		15			50	700		MHz
DC Forward-Current Transfer Ratio	h_{FE}		15			50	35	120	
Voltage Gain	VG		15			50	11		dB
Cross Modulation @46dBmV	CM		15			50	−57 (Typ.)		dB

[a] Pulsed through an inductor (20mH); duty factor = 50%; R_{BE} = 100 Ω.

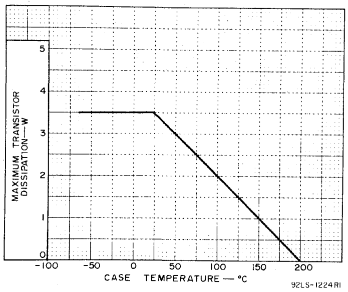


Fig. 1 - Dissipation derating curve.

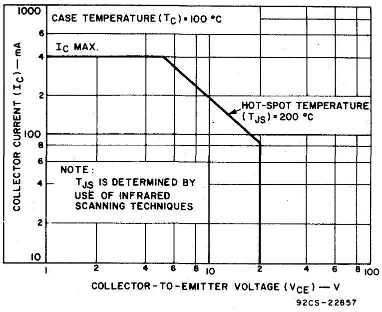


Fig. 2 - Safe area for dc operation.

40894-40897

High - Frequency Silicon N-P-N Transistors

For TV-Tuner, FM and AM/FM "Front-End", and IF Amplifier, Oscillator, and Converter Service

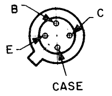
Features:

- High gain-bandwidth products:
  f_T = 1200 MHz typ. for tuner types
  = 800 MHz typ. for if-amplifier types
- Very low collector-to-base feedback capacitance:
  C_{cb} = 0.7 pF typ. for 40894, 40895
- Low noise figure:
  3 dB typ. at 200 MHz for rf amplifier type
- High power gain as neutralized amplifier:
  G_{PE} = 15 dB min. at 200 MHz (40894)
- High power output as uhf oscillator:
  P_{OE} = 20 mW typ. at 500 MHz (40896)
- Low noise figure:
  NF = 4.5 dB max. at 200 MHz (40894)
- Low collector-to-base time constant:
  $r_b'C_c$ = 14 ps max.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

COLLECTOR-TO-EMITTER VOLTAGE	V_{CEO}	12	V
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	20	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	2.5	V
CONTINUOUS COLLECTOR CURRENT	I_C	50	mA
TRANSISTOR DISSIPATION	P_T		
With heat sink, at case temperatures up to 25°C		300	mW
With heat sink, at case temperatures above 25°C		Derate linearly 1.71	mW/°C
At ambient temperatures up to 25°C		200	mW
At ambient temperatures above 25°C		Derate linearly 1.14	mW/°C
TEMPERATURE RANGE:			
Storage & Operating (Junction)		-65 to +200	°C
CASE TEMPERATURE (During soldering):			
At distances ≥ 1/32 in. (0.8 mm) from seating surface for 10 seconds max.		265	°C

TERMINAL DESIGNATIONS



92CS-27513

JEDEC TO-72

ELECTRICAL CHARACTERISTICS at Ambient Temperature (T_A) = 25°C unless otherwise specified

CHARACTERISTICS	SYMBOLS	TEST CONDITIONS							LIMITS												UNITS
		FREQUENCY MHz	DC COLLECTOR OR EMITTER VOLTAGE V			DC CURRENT mA			TYPE 40894 RF AMPLIFIER			TYPE 40895 MIXER			TYPE 40896 OSCILLATOR			TYPE 40897 IF AMPLIFIER			
			V_{CB}	V_{CE}	V_{EB}	I_E	I_C	I_B	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Collector-Cutoff Current	I_{CBO}		15			0			-	-	0.02	-	-	0.02	-	-	0.02	-	-	0.02	µA
T_A = 150°C			15			0			-	-	1	-	-	1	-	-	1	-	-	1	
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$					0	0.001		20	-	-	20	-	-	20	-	-	20	-	-	V
Collector-to-Emitter Sustaining Voltage	$V_{CEO}(sus)$						3	0	15	-	-	15	-	-	15	-	-	15	-	-	V
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$					0.01	0		2.5	-	-	2.5	-	-	2.5	-	-	2.5	-	-	V
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$						10	1	-	-	0.4	-	-	0.4	-	-	0.4	-	-	0.4	V
Base-to-Emitter Saturation Voltage	$V_{BE}(sat)$						10	1	-	-	1	-	-	1	-	-	1	-	-	1	V
Static Forward Current-Transfer Ratio	h_{FE}			6			1		50	80	250	40	70	250	27	50	250	70	120	250	
Magnitude of Common-Emitter, Small-Signal Short-Circuit, Forward Current Transfer Ratio[a]	$\|h_{fe}\|$	100 1 kHz		6 6			5 2		9 25	14 90	20 300	9 25	14 90	20 300	9 25	14 90	20 300	9 25	14 90	20 300	
Collector-to-Base Feedback Capacitance[b]	C_{cb}	0.1 to 1	10			0			-	0.7	1	-	0.7	1	-	0.7	1	-	0.7	1	pF
Common-Base Input Capacitance[c]	C_{ib}	0.1 to 1			0.5		0		-	-	2	-	-	2	-	-	2	-	-	2	pF
Collector-to-Base Time Constant[a]	$r_b'C_c$	31.9	6				2		3	7	14	3	7	14	3	7	14	3	7	14	ps
Small-Signal Power Gain in Neutralized Common-Emitter Amplifier Circuit[a]	G_{PE}	10.7 200		12 12			5 5		- 15	- 21	- -	- 15	- 21	- -	- 15	- 21	- -	18 -	25 -	- -	dB
Noise Figure[a]	NF	200		6			1.5		-	3	4.5	-	-	-	-	-	-	-	-	-	dB

[a] Lead No. 4 (case) grounded; R_g = 125Ω

[b] Three-terminal measurement of the collector-to-base capacitance with the case and emitter leads connected to the guard terminal.

[c] Lead No. 4 (case) floating.

40915

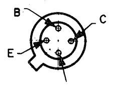
0.2-to-1.4-GHz Low-Noise Silicon N-P-N Transistor

For High-Gain Small-Signal Applications

Features:

- **Low noise figure:**
  NF = 2.5 dB (max.) with 11 dB gain at 450 MHz
  = 3.0 dB (typ.) at 890 MHz
  = 4.5 dB (typ.) at 1.3 GHz
- **High gain (tuned, unneutralized):**
  G_{PE} = 14 dB (min.) at 450 MHz
  = 6.5 dB (typ.) at 1.3 GHz
- **High gain-bandwidth product**
- **Large dynamic range**
- **Low distortion**

TERMINAL DESIGNATIONS



CASE

92CS-27513

JEDEC TO-72

MAXIMUM RATINGS, *Absolute-Maximum Values:*

Collector-to-Base Voltage	V_{CBO}	35	V
Collector-to-Emitter Voltage	V_{CEO}	15	V
Emitter-to-Base Voltage	V_{EBO}	3.5	V
Collector Current (Continuous)	I_C	40	mA

Transistor Dissipation:	P_T	
At ambient temperatures up to 25°C		200 mW
At ambient temperatures above 25°C		Derate linearly at 1.14 mW/°C
Temperature Range:		
Storage and Operating (Junction)		−65 to +200 °C

ELECTRICAL CHARACTERISTICS at Ambient Temperature (T_A) = 25°C

CHARACTERISTIC	SYMBOL	TEST CONDITIONS					LIMITS		UNITS
		DC COLLECTOR VOLTAGE (V)		DC CURRENT (mA)					
		V_{CB}	V_{CE}	I_E	I_B	I_C	MIN.	MAX.	
STATIC									
Collector Cutoff Current	I_{CBO}	10		0			–	20	nA
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$			0		0.01	35	–	V
Collector-to-Emitter Breakdown Voltage	$V_{(BR)CEO}$				0	0.1	15	–	V
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$			0.01		0	3.5	–	V
DC Forward-Current Transfer Ratio	h_{FE}		10			3	20	–	–
Thermal Resistance: (Junction-to-Ambient)	$R_{\theta JA}$						–	880	°C/W
DYNAMIC									
Device Noise Figure (f = 450 MHz)	NF		10			1.5	–	2.5	dB
Small-Signal Common-Emitter Power Gain (f = 450 MHz) Unneutralized Amplifier	G_{PE}		10			1.5	14	–	dB
At minimum noise figure	G_{PE}		10			1.5	11.0	–	dB
Collector-to-Base Output Capacitance (f = 1 MHz)	C_{obo}	10		0			–	1.0	pF

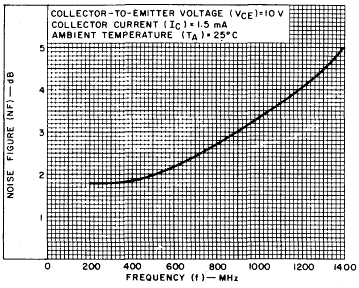


Fig. 1 - Typical noise figure as a function of frequency.

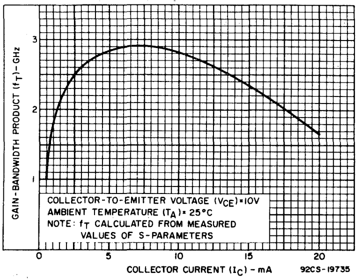


Fig. 2 - Gain-bandwidth product as a function of collector current.

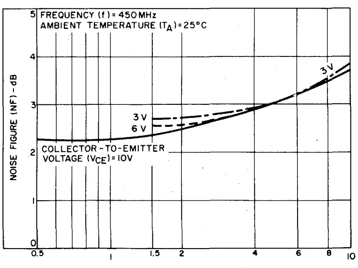


Fig. 3 - Typical noise figure as a function of collector current.

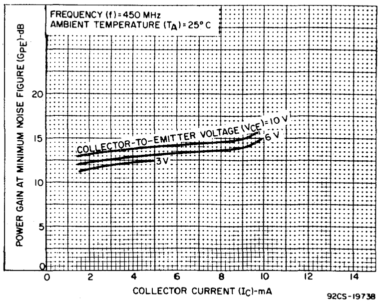


Fig. 4 - Typical power gain (at minimum noise figure) as a function of collector current.

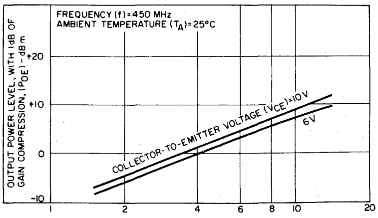


Fig. 5 - Typical output power level (with 1 dB of gain compression) as a function of collector current.

40936

20-W(PEP) Emitter-Ballasted Overlay Transistor

For 2- to-30-MHz Single-Sideband Linear Amplifier Applications

Features:

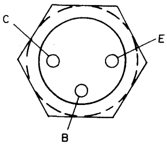
- **For class A or class B amplifier service**
- **Integral emitter-ballasting resistors**
- **20 W(PEP) output (min.) at 30 MHz with: gain = 13 dB (min.); collector efficiency = 40% (min.); intermodulation distortion = −30 dB (max.)**
- **Low-Thermal-Resistance Package**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

COLLECTOR-TO-EMITTER VOLTAGE:			
With V_{BE} = −1.5 V	V_{CEV}	65	V
With external base-to-emitter resistance R_{BE} = 5 Ω	V_{CER}	40	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	4	V
COLLECTOR CURRENT:			
Peak		10	A
Continuous	I_C	3.3	A

TRANSISTOR DISSIPATION	P_T		
At case temperatures up to 75°C		50	W
At case temperatures above 75°C		Derate linearly at 0.4 W/°C.	
TEMPERATURE RANGE:			
Storage & Operating (Junction)		−65 to 200	°C
LEAD TEMPERATURE (During soldering):			
At distances ≥ 1/32 in. (0.787 mm) from insulating wafer for 10 s max		230	°C

TERMINAL DESIGNATIONS



92CS-27481

JEDEC TO-60

ELECTRICAL CHARACTERISTICS, at Case Temperature (T_C) = 25°C

STATIC

CHARACTERISTIC	SYMBOL	TEST CONDITIONS					LIMITS		UNITS
		DC COLLECTOR VOLTAGE (V)		DC BASE VOLTAGE (V)	DC CURRENT (mA)				
		V_{CB}	V_{CE}	V_{BE}	I_E	I_C	MIN.	MAX.	
Collector-to-Emitter Sustaining Voltage: With base-emitter junction reverse biased	V_{CEV}(sus)			−1.5		200^a	65	–	V
With external base-to-emitter resistance (R_{BE})=5Ω	V_{CER}(sus)					200^a	40	–	V
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$				20		4	–	V
Collector-to-Emitter Cutoff Current	I_{CEO}		30				–	5.0	mA
Collector-to-Base Cutoff Current	I_{CBO}	60					—	10	mA
Collector-to-Base Capacitance (f = 1 MHz)	C_{obo}	30					–	85	pF
Thermal Resistance (Junction-to-Case)	$R_{\theta JC}$						–	2.5	°C/W

[a] Pulsed through an inductor (25 mH); duty factor = 50%.

DYNAMIC (30-MHz Single-Sideband Amplifier)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS		UNITS
		DC COLLECTOR SUPPLY VOLTAGE (V)	OUTPUT POWER W(PEP)	FREQUENCY (MHz)	DC CURRENT (mA)			
		V_{CC}	P_{OE}	f	I_C	MIN.	MAX.	
RF Input Power: Average	P_{IE}	28	10	30	20	–	0.5	W
Peak envelope (PEP)	P_{IE}	28	20	30	20	–	1.0	W
Power Gain	G_{PE}	28	20	30	20	13	–	dB
Collector Efficiency	η_C	28	20	30	20	40	–	%
Intermodulation Distortion*	IMD	28	20	30	20	–	-30	dB

*Referenced to either of the two tones, and without the use of feedback to enhance linearity.

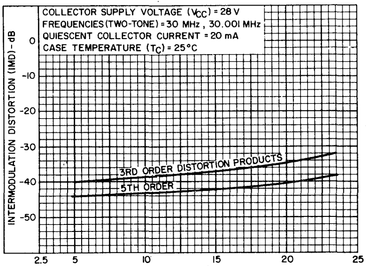


Fig. I - Typical intermodulation distortion as a function of output power.

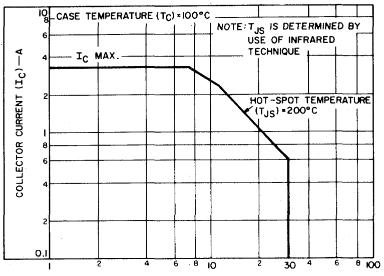


Fig. 2 - Maximum operating area for forward-bias operation.

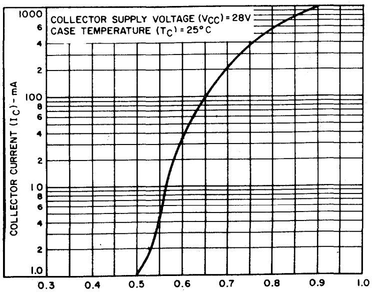


Fig. 3 - Typical transfer characteristic.

40964, 40965

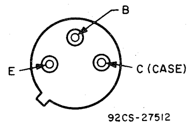
Silicon N-P-N Overlay Transistors

High-Gain Devices for Class C VHF/UHF Multiplier and Amplifier Service

Features:

- **High power gain:**
  6 dB (min.) up to f = 470 MHz (40964 tripler)
  7 dB (min.) at f = 470 MHz (40965 amplifier)

TERMINAL DESIGNATIONS



JEDEC TO-39

MAXIMUM RATINGS, *Absolute-Maximum Values:*

COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	36	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:			
With external base-to-emitter resistance (R_{BE}) = 33Ω	$V_{CER}(sus)$	36	V
With base open	$V_{CEO}(sus)$	14	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	2	V
CONTINUOUS COLLECTOR CURRENT	I_C	0.2	A
TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 25°C		3.5	W
TEMPERATURE RANGE:			
Storage & Operating (Junction)		-65 to 200	°C
LEAD TEMPERATURE (During soldering):			
At distances ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max		230	°C

ELECTRICAL CHARACTERISTICS, Case Temperature (T_C) = 25°C

STATIC

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS		UNITS
		Voltage V dc	Current mA dc			40964 40965		
		V_{CE}	I_E	I_B	I_C	Min.	Max.	
Collector-Cutoff Current	I_{CEO}	10		0		–	0.1	mA
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$		0			36	–	V
Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO}(sus)$			0	5[a]	14	–	V
With external base-to-emitter resistance (R_{BE}) = 33Ω	$V_{CER}(sus)$				5[a]	36	–	
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$		0.1		0	2	–	V
Thermal Resistance: (Junction-to-Case)	$R_{\theta JC}$					–	50	°C/W

[a] Pulsed through a 25-mH inductor; duty factor = 50%.

DYNAMIC

CHARACTERISTIC	SYMBOL	TEST CONDITIONS			LIMITS				UNITS
		Collector Supply (V_{CC}) - V dc	Input Power (P_{IE}) - W	Frequency (f) - MHz	40964		40965		
					Min.	Typ.	Min.	Typ.	
Power Output	P_{OE}	12	0.1	156.7-470	0.4	0.44	–	–	W
				470	–	–	0.5	0.55	
		8	0.1	156.7-470	–	0.33	–	–	
				470	–	–	–	0.33	
Power Gain	G_{PE}	12	0.1	156.7-470	6	6.4	–	–	dB
				470	–	–	7	7.4	
		8	0.1	156.7-470	–	5.2	–	–	
				470	–	–	–	5.2	
Collector Efficiency	η_C	12	0.1	156.7-470	25	–	–	–	%
				470	–	–	40	–	
		8	0.1	156.7-470	–	25	–	–	
				470	–	–	–	40	
Collector-to-Base Capacitance	C_{obo}	V_{CB} = 12 V I_C = 0	–	1	–	5 (max.)	–	5 (max.)	pF
Gain-Bandwidth Product	f_T	V_{CE} = 12 V I_C = 50 mA	–	–	–	700	–	700	MHz

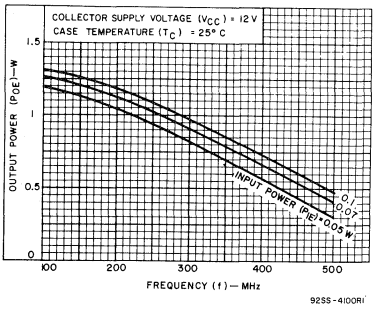


Fig. 1 - Typical power output as a function of frequency for 40965.

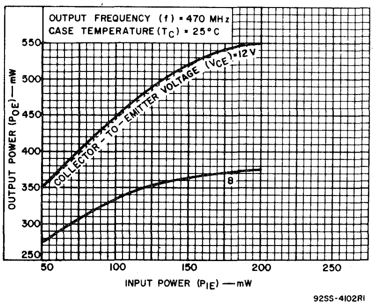


Fig. 2 - Typical power output as a function of power input for 40964.

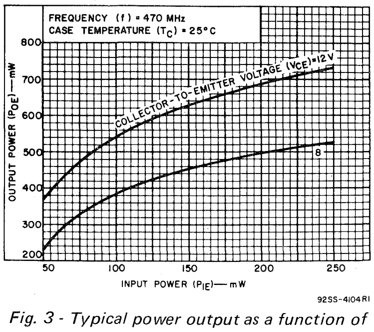


Fig. 3 - Typical power output as a function of power input for 40965.

41024

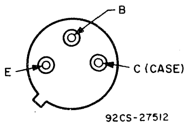
1-W, 1-GHz Silicon N-P-N Overlay Transistor

High-Gain Device for Class B- or C- Operation in UHF Circuits

Features:

- 1-watt output min. at 1 GHz (5 dB gain)
- For sonde applications
  0.3-watt output typ. at 1.68 GHz (V_{CC} = 20 V)

TERMINAL DESIGNATIONS



JEDEC TO-39

MAXIMUM RATINGS, *Absolute-Maximum Values:*

COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	55	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:			
With external base-to-emitter resistance (R_{BE}) = 10 Ω	V_{CER}	55	V
With base open	V_{CEO}	24	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	3	V
CONTINUOUS COLLECTOR CURRENT	I_C	0.4	A
TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 25°C		3.5	W
At case temperatures above 25°C		See Fig. 1	
TEMPERATURE RANGE:			
Storage and Operating (Junction)		−65 to 200	°C
LEAD TEMPERATURE (During soldering):			
At distances ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max.		230	°C

ELECTRICAL CHARACTERISTICS, Case Temperature (T_C) = 25°C

CHARACTERISTIC	SYMBOL	TEST CONDITIONS Voltage V dc V_{CB}	V_{CE}	Current mA dc I_E	I_B	I_C	LIMITS Min.	Max.	UNITS
Collector Cutoff Current: With base open	I_{CEO}		15		0		–	20	µA
With base connected to emitter	I_{CES}		50				–	1	
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$			0		0.1	55	–	V
Collector-to-Emitter Sustaining Voltage: With external base-to-emitter resistance (R_{BE}) = 10 Ω	$V_{CER}(sus)$					5	55	–	V
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$			0.1		0	3	–	V
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$				10	100	–	0.5	V
Collector-to-Base Capacitance (Measured at 1 MHz)	C_{ob}	30		0			–	3.0	pF
Magnitude of Common-Emitter Small-Signal Short-Circuit Forward-Current Transfer Ratio (Measured at 200 MHz)	$\lvert h_{fe} \rvert$		15			50	6.0	–	
RF Power Output Common Emitter Amplifier at 1 GHz	P_{OUT}		28				1[a]	–	W

[a] For P_{IN} = 0.316 W, minimum efficiency = 35%.

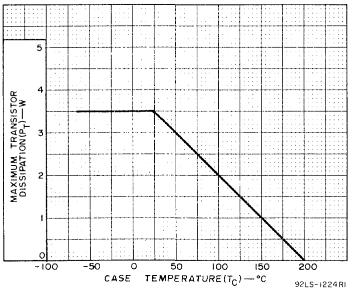


Fig. 1 - Derating curve.

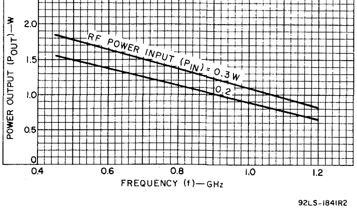


Fig. 2 - Typical power output vs. frequency.

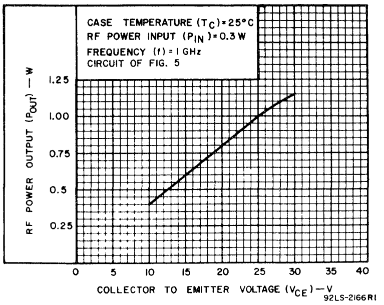


Fig. 3 - Typical rf power output as a function of collector-to-emitter voltage.

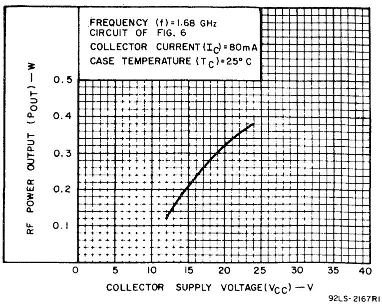


Fig. 4 - Typical oscillator power output as a function of collector supply voltage.

Power Hybrid Circuits

Technical Data

HC2000H, HC2500
Multi-Purpose 7-Ampere Operational Amplifiers

Linear Amplifiers for Applications in Industrial and Commercial Equipment

The RCA-HC2000H and HC2500 hybrid-circuit operational amplifiers are designed for operation from either single or split power supplies at output currents up to 7 amperes and power outputs up to 100 watts. These versatile amplifiers are recommended for servoamplifiers, audio power amplifiers, driven inverters, power operational amplifiers, deflection amplifiers, solenoid drivers, voltage regulators, and similar linear-amplifier power applications. They are supplied in a metal hermetic package.

The HC2000H and HC2500 employ a quasi - complementary - symmetry output stage with hometaxial-base output transistors. They feature low distortion, with a maximum total harmonic distortion of 0.5 per cent over a bandwidth of 30 kHz at a power output of 60 watts and a typical intermodulation distortion of less than 1 per cent at rms power outputs from 0.2 to 70 watts. At an rms output of 50 milliwatts, the HC2500 has an exceptionally low typical intermodulation distortion of only 0.06 per cent.

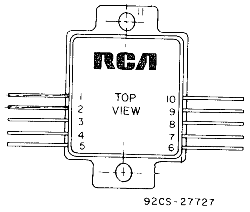
The HC2000H includes a load-line limiting network that provides protection against short-circuit loads and against high-energy transients when the amplifier is used to drive inductive loads. Both circuits also feature adjustable idling current and direct coupling to the load.

High-reliability versions of the HC2000H are also available for use in aerospace, military, and critical industrial applications. These types are screened to four reliability levels (/1, /2, /3, and /4) that approximate the reliability classes of MIL-STD-750. These slash-series types are the electronic industry's first series of high-reliability high-power hybrid-circuit op-amps.

Features:

- Bandwidth: 30 kHz at 60 W
- High power output: up to 100 W(rms)
- High output current: 7A (peak)
- Low IMD and THD
- Adjustable idling current
- Stability with resistive or reactive loads
- Single or split power supply (30 to 75 V, single, ± 15 to ±37.5, split)
- Class AB output stage (HC2500)
  Class B output state (HC2000H)
- Direct coupling to load
- Built-in load-line-limiting circuit to protect amplifiers from accidentally short-circuited output terminals (HC2000H)
- Reactive-load fault protection (HC2000H)
- Socket available
- Rugged package with heavy leads
- Light weight: 100 grams

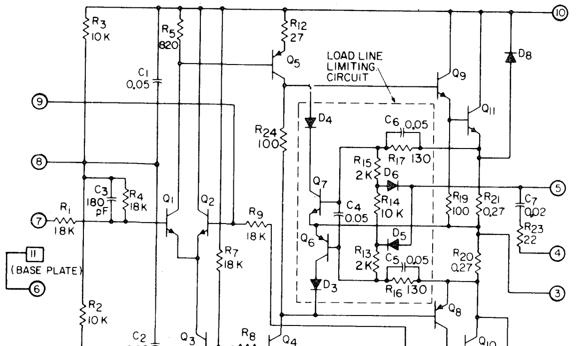
TERMINAL DESIGNATION



HC2000H, HC2500

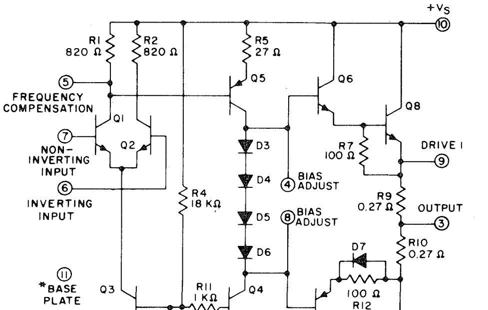
MAXIMUM RATINGS, *Absolute-Maximum Values:*

	HC2000H HC2500
V_S:	
Between leads 1 & 10	75 V
I_{OM}	7 A
P_T:	
Per Output Device	See Figs. 3 & 4
T_{stg}	−55 to +125°C
T_J	−55 to +150°C
T_L (During Soldering):	
At distance ≥1/8 in. (3.17 mm) from case for 10 s max.	235°C
ϕL (Min):	
At distance ≥0.075 (1.91 mm) from case	0.04 in. (1.02 mm)



RESISTANCE VALUES IN OHMS
CAPACITANCE VALUES IN MICROFARADS
UNLESS OTHERWISE SPECIFIED

Fig. 1 – Schematic diagram of type HC2000H operational amplifier.



*ELECTRICALLY ISOLATED FROM INTERNAL CIRCUITRY.

Fig. 2 – Schematic diagram of type HC2500 operational amplifier.

COMPARISON CHART

TYPE	IM DIST.	OUTPUT PROTECTION NETWORK	OPERATING MODE	FREQUENCY COMPENSATION	COMMUTATING DIODES
HC2500	0.06% @ 50 mW	NO	CLASS AB	CAPACITOR ON SIGNAL TERMINALS	NO
HC2000H	0.6% @ 200 mW	YES	CLASS B	LC FILTER ON OUTPUT	YES

HC2000H

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C*

CHARACTERISTIC	TEST CONDITIONS				LIMITS			UNITS
	V_S –V	f –kHz	P_O –W	R_L –Ω	MIN.	TYP.	MAX.	
$\frac{V_{OUT}}{V_{IN}}$ Open-Loop	±37.5	4	25	4	–	2000	–	
Closed-Loop	±37.5	1	1	4	26	30	–	
Z_{IN} Measured between leads 7 & 8	–	–	–	–	16	18	–	kΩ
I_o	±37.5	–	–	–	15	–	30	mA
V_{IO} Measured between leads 4 & 5	±37.5	–	–	4	0	±30	±250	mV
V_{OUT}	±37.5	1	100	4	28	32	–	V
f_H (See Fig.9)	±37.5	–	1	4	43	–	–	kHz
THD (See Fig. 10)	±37.5	1	60	4	–	0.4	0.5	%
I_S (See Fig. 12)	±37.5	1	–	0	±2	–	±3.85	A
S/N Z_G = 600 Ω	±37.5	–	–	–	–	78	–	dB
SR (Unity gain, I_{OM} = 4A)	±37.5	1	100	4	5	–	–	V/µs
$R_{\theta JC}$ Per Output Device (See Figs. 3 & 4)	–	–	–	–	–	–	2	°C/W

HC2500

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C and Supply Voltage (V_S) = ±37.5 V*

CHARACTERISTIC	REFERENCE FIG. NO.	TEST CONDITIONS				LIMITS			UNITS
		SPECIAL NOTES	FREQ. (f)–kHz	OUTPUT POWER (P_O)–W	LOAD RESIST. (R_L)–Ω	MIN.	TYP.	MAX.	
V_{offset}		Measured Pin 3 to Gnd	–	–	4	–	–	±250	mV
I_o		Idling Current < 1 mA	–	–	Open	–	–	±30	mA
V_{OUT}		Peak dc voltage	0	200	4	28	–	–	V
f_H			–	1	4	43	–	–	kHz
THD	21		1	60	4	–	0.3	0.5	%
A_{CL}			1	1	4	31	32	–	
$R_{\theta JC}$	3, 4		–	–	–	–	–	2	°C/W

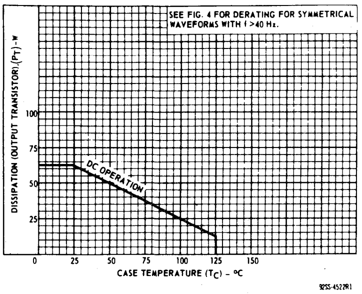


Fig. 3 — Dissipation (dc) derating curve for each output transistor for both types.

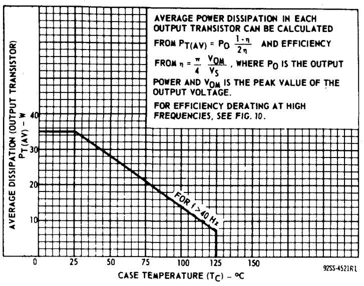


Fig. 4 — Dissipation (average) derating curve for each output transistor (for symmetrical wave-forms with f >40 Hz) for both types.

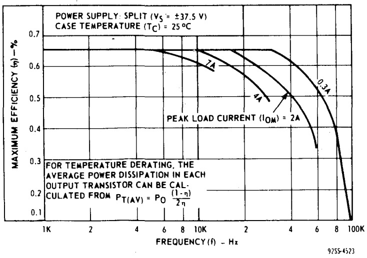


Fig. 5 — Maximum efficiency vs. frequency for several values of peak load current for both types.

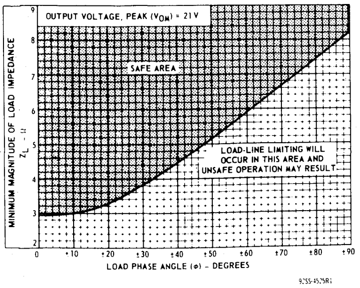


Fig. 6 — Minimum load impedance vs. load phase angle and safe area of operation for both types.

HC2000H, HC2500

HC2500

ELECTRICAL CHARACTERISTICS (Cont'd)

Typical Values (for Design Guidance), *At Case Temperature (T_C) = 25°C and Supply Voltage (V_S) = ±37.5*

CHARACTERISTIC	REFERENCE FIG. NO.	TEST CONDITIONS				LIMITS			UNITS
		SPECIAL NOTES	FREQ. (f)–kHz	OUTPUT POWER (P_O)–W	LOAD RESIST. (R_L)–Ω	MIN.	TYP.	MAX.	
A_{OL}	16	Idling current = 50 mA	1	25	4	–	70	–	dB
V_{IO}			–	0	Open	–	±10	–	mV
I_{IO}			–	0	Open	–	7	–	μA
I_{IB}			–	0	Open	–	20	–	μA
R_{CM}			0.005	0	Open	–	1	–	MΩ
V_{ICR}			0.5	100	4	–	32	–	V
CMRR			0.005	0	Open	–	50	–	dB
V_{RR}			0.06	0	4	–	30	–	dB
IMD	20	Idling current = 50 mA	–	0.05	4	–	0.06	–	%
SR	24	A_{CL} = 2 C_c = 100 pF	0.5 Square Wave	–	4	–	4.3	–	V/μs
ΔI_i	23	25°C to 100°C	–	–	4	–	1	–	mA/°C

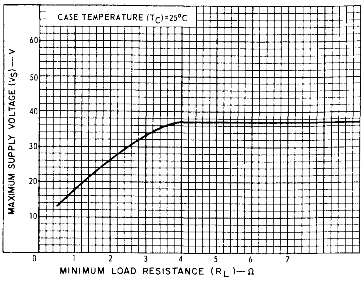


Fig. 7 — Maximum allowable supply voltage vs. load resistance for HC2000H.

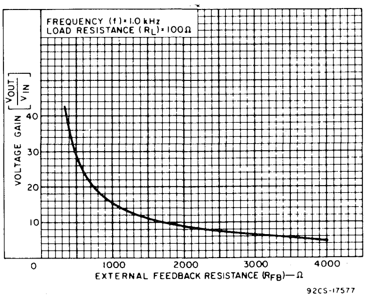


Fig. 8 — Closed-loop voltage gain vs. external feedback resistance for HC2000H.

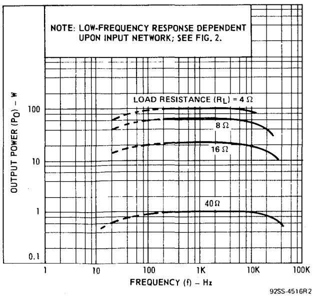


Fig. 9 — Output power vs. frequency for HC2000H.

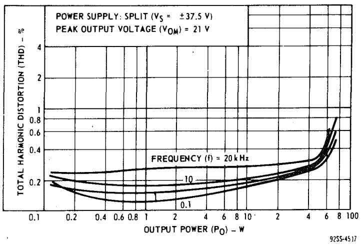


Fig. 10 — Total harmonic distortion with split power supply for HC2000H.

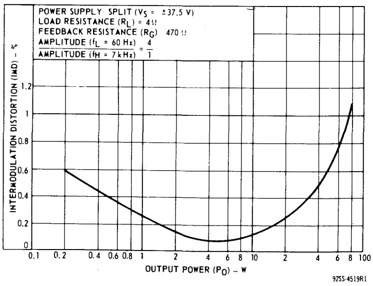


Fig. 11 — Intermodulation distortion with split supply and 4-ohm load for HC2000H.

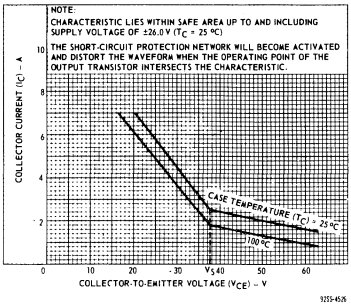


Fig. 12 — Characteristics of built-in load-line-limiting circuit for HC2000H.

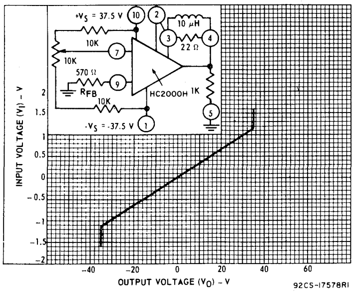


Fig. 13 — Gain linearity characteristics for HC2000H.

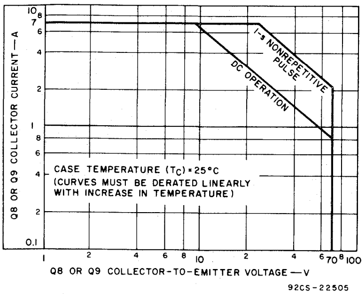


Fig. 14 — Maximum operating area for HC2500.

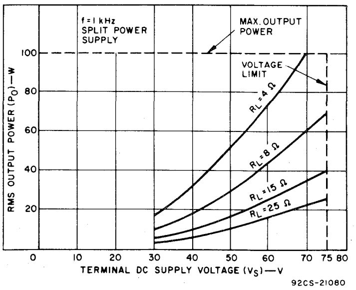


Fig. 15 — Output power as a function of supply voltage, with various values of load resistance, for symmetrical sine-wave operation for HC2500.

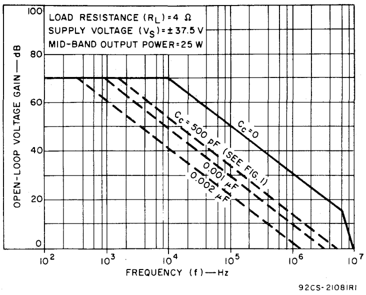


Fig. 16 — Typical open-loop voltage gain vs. frequency for HC2500.

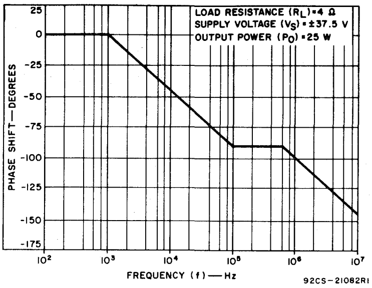


Fig. 17 — Typical open-loop phase shift vs. frequency for HC2500.

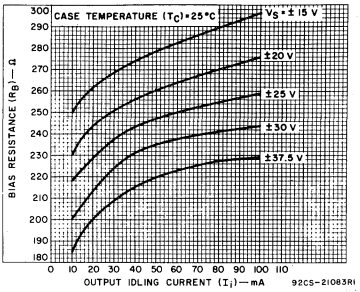


Fig. 18 — Bias resistor value vs. output idling current (I_i) for HC2500.

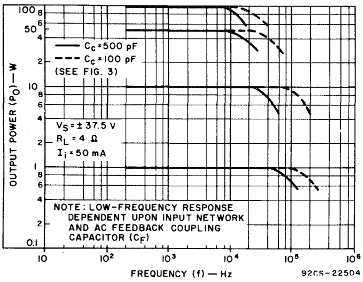


Fig. 19 — Output power vs. frequency for HC2500.

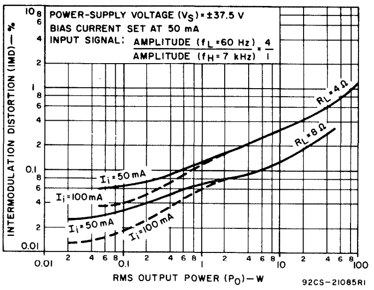


Fig. 20 — Typical intermodulation distortion vs. rms output power for HC2500.

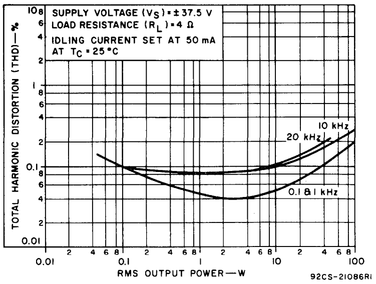


Fig. 21 — Typical harmonic distortion vs. rms output power for HC2500.

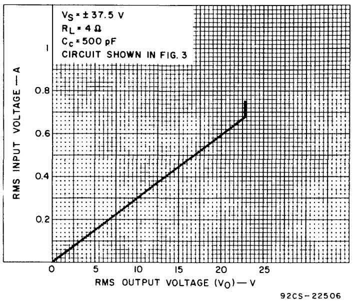


Fig. 22 — Input sensitivity for HC2500.

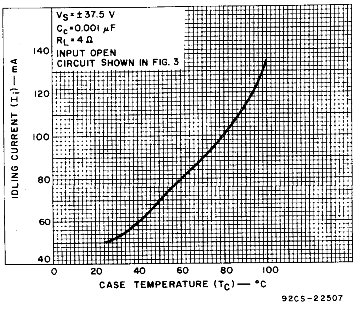


Fig. 23 — Typical idling-current drift for HC2500.

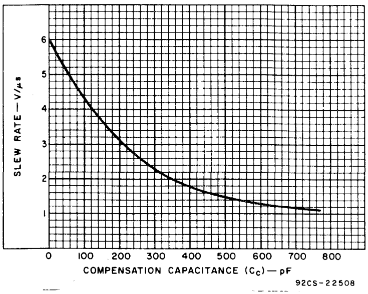


Fig. 24 — Typical slew rate vs. value of compensation capacitor C_c for HC2500.

Triacs

Technical Data

T2300, T2301, T2302, T2310, T2311, T2312 Series

2.5-A Sensitive-Gate Silicon Triacs

Mod. TO-5 and Mod. TO-5 with Heat Radiator Packages For AC Power Switching

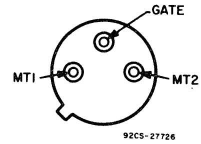
The RCA-T2300, T2301, T2302, T2310, T2311, T2312 series triacs are gate-controlled full-wave silicon ac switches that are designed to switch from an off-state to an on-state for either polarity of applied voltage with positive or negative gate triggering voltages.

The T2310, T2311, and T2312 series are the same as the T2300, T2301, and T2302 series, respectively, but have factory-attached heat radiators and are intended for printed-circuit-board applications.

The gate sensitivity of these triacs permits the use of economical transistorized control circuits and enhances their use in low-power phase-control and load-switching applications.

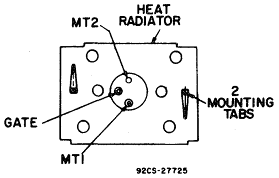
Features:
- Very high gate sensitivity—3, 4, and 10 mA
- di/dt capability—100 A/µs
- Shorted-emitter, center-gate design
- Low switching losses
- Low on-state voltage at high current levels

TERMINAL CONNECTIONS



T2300
T2301
T2302
Series

Modified TO-5



T2310
T2311
T2312
Series

Mod. TO-5 with Heat Radiator

MAXIMUM RATINGS, *Absolute-Maximum Values:*
For Operation with Sinusoidal Supply Voltage at Frequencies
Up to 50/60 Hz and with Resistive or Inductive Load

3 mA Gate	T2300F	T2300A	T2300B	T2300D	
4 mA Gate	T2301F	T2301A	T2301B	T2301D	
10 mA Gate	T2302F	T2302A	T2302B	T2302D	
3 mA Gate	T2310F	T2310A	T2310B	T2310D	
4 mA Gate	T2311F	T2311A	T2311B	T2311D	
10 mA Gate	T2312F	T2312A	T2312B	T2312D	
V_{DROM}▲					
Gate open, T_J=−40 to 100°C	50	100	200	400	V
$I_{T(RMS)}$ (θ = 360°):					
T_C = 70°C	2.5				A
T_A = 25°C	1.9				A
For other conditions	See Figs. 2,3,4,5				
I_{TSM}:					
For one cycle of applied principal voltage, at current and temperature shown above for $I_{T(RMS)}$:					
60 Hz (sinusoidal)	25				A
50 Hz (sinusoidal)	21				A
For more than one cycle of applied principal voltage	See Figs. 6,7				
di/dt:					
$V_D = V_{DROM}$, I_{GT} = 50 mA, t_r = 0.1 µs	100				A/µs
I^2t [At T_C shown for $I_{T(RMS)}$]:					
t = 20 ms	4.3				A^2s
= 2.5 ms	2				A^2s
= 0.5 ms	1				A^2s
For other time values	See Fig. 7				
I_{GTM}•:					
For 1 µs max.	1				A
P_{GM}:					
Peak (For 1 µs max., I_{GTM} ≤ 1 A(peak)	10				W
$P_{G(AV)}$:					
T_C = 60°C	0.15				W
T_A = 25°C	0.05				W
T_{stg}■	−40 to 150				°C
T_C■	−40 to 100				°C
T_T■:					
During soldering for 10 s maximum at distance ≥ 1/16 in. (1.58 mm) from seating plane	225				°C

▲ For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.

• For either polarity of gate voltage (V_G) with reference to main terminal 1.

■ For temperature measurement reference point, see Dimensional Outlines.

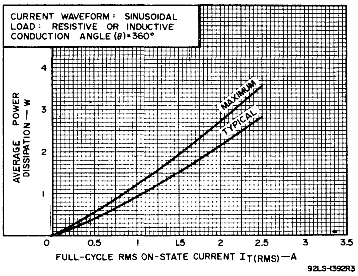


Fig. 1—Power dissipation vs. on-state current.

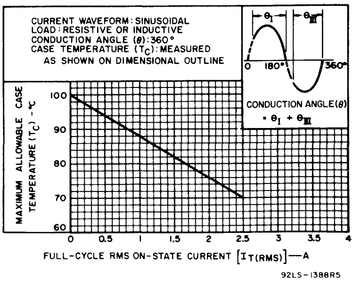


Fig. 2—Maximum allowable case temperature vs. on-state current.

T2300, T2301, T2302, T2310, T2311, T2312 Series

ELECTRICAL CHARACTERISTICS
At Maximum Ratings Unless Otherwise Specified and at Indicated Case Temperature (T_C)

CHARACTERISTIC	LIMITS FOR ALL TYPES Except as Specified			UNITS
	Min.	Typ.	Max.	
I_{DROM}▲:				
Gate open, T_J=100°C, V_{DROM}=Max.rated value	–	0.2	0.75	mA
V_{TM}▲:				
i_T=10 A(peak), T_C=25°C	–	1.7	2.2	V
I_{HO}▲: *(See Figs. 9 & 10)*				
Gate open, Initial principal current=150 mA (dc),				
v_D=12 V, T_C=25°C				
(T2300, T2301, T2310, T2311 series)	–	2	5	mA
(T2302, T2312 series)	–	7	15	
dv/dt (Commutating)▲:				
v_D=V_{DROM}, $I_{T(RMS)}$=2.5 A, commutating di/dt=0.95 A/ms,				
gate unenergized, T_C=100°C	0.5	–	–	V/μs
dv/dt (Off-state)▲:				
v_D=V_{DROM}, exponential voltage rise, gate open,				
T_C= 90°C (T2300, T2301, T2310, T2311 series)	3	5	–	V/μs
T_C=100°C (T2302, T2312 series)	6	10	–	
I_{GT}▲●: *(See Figs. 13 & 14)*				
v_D=12 V dc, R_L=30 Ω, T_C=25°C				
Mode V_{MT2} V_G				
I^+ positive positive				
T2300, T2310 series	–	1	3	mA
T2301, T2311 series	–	1	4	
T2302, T2312 series	–	3.5	10	
III^- negative negative				
T2300, T2310 series	–	1	3	
T2301, T2311 series	–	1	4	
T2302, T2312 series	–	3.5	10	
I^- positive negative				
T2300, T2310 series	–	2	3	
T2301, T2311 series	–	2	4	
T2302, T2312 series	–	7	10	
III^+ negative positive				
T2300, T2310 series	–	2	3	
T2301, T2311 series	–	2	4	
T2302, T2312 series	–	7	10	
V_{GT}▲●: *(See Fig. 15)*				
v_D=12 V dc, R_L=30 Ω, T_C=25°C	–	1	2.2	V
v_D=V_{DROM}, R_L= 3 kΩ , T_C=100°C	0.15	–	–	
t_{gt}:				
v_D=V_{DROM}, I_{GT}=60 mA, t_r=0.1 μs, i_T=10 A(peak), T_C=25°C	–	1.8	2.5	μs
$R_{\theta JC}$:				
Steady-state	–	–	8.5	°C/W
$R_{\theta JA}$	–	–	150	

▲For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.

●For either polarity of gate voltage (V_G) with reference to main terminal 1.

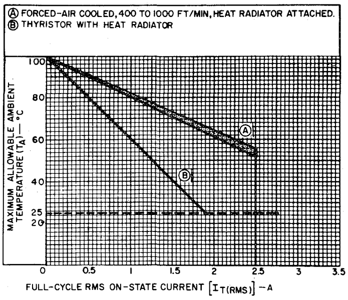


Fig. 3—Maximum allowable ambient temperature vs. on-state current for T2310, T2311, T2312 series.

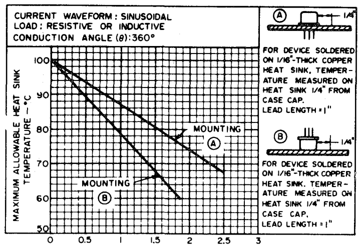


Fig. 4—Maximum allowable heat-sink temperature vs. on-state current for T2300, T2301, T2302 series.

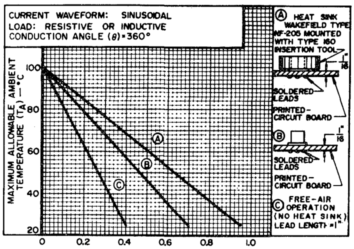


Fig. 5—Maximum allowable ambient temperature vs. on-state current for T2302 series.

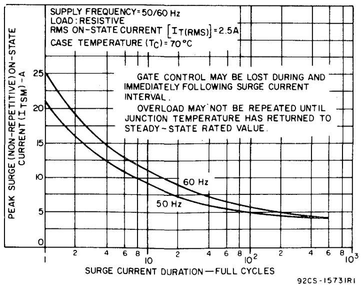


Fig. 6—Peak surge on-state current vs. surge-current duration.

T2300, T2301, T2302, T2310, T2311, T2312 Series

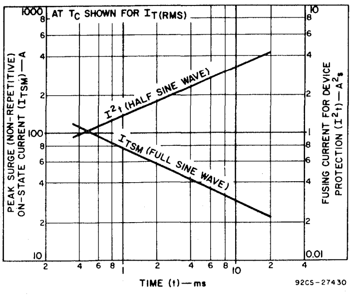


Fig. 7—Peak surge on-state current and fusing current vs. time.

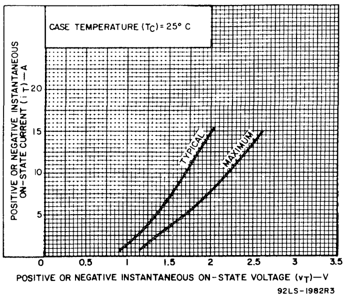


Fig. 8—On-state current vs. on-state voltage for all standard series.

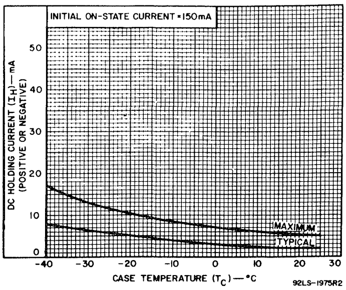


Fig. 9—DC holding current (positive or negative) vs. case temperature for T2300, T2301, T2310, T2311 series.

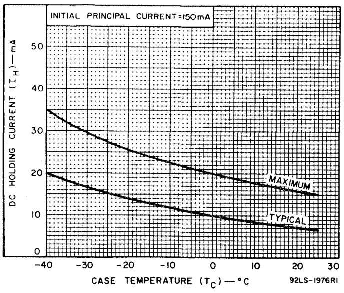


Fig. 10—DC holding current (positive or negative) vs. case temperature for T2302, T2312 series.

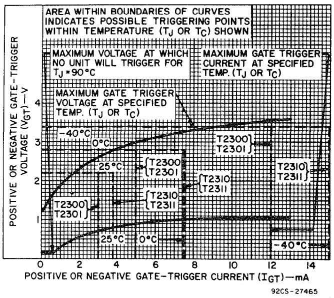


Fig. 11—Gate-trigger voltage vs. gate-trigger current for T2300, T2301, T2310, T2311 series.

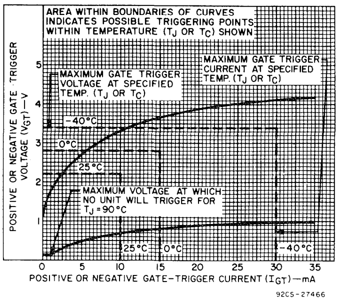


Fig. 12—Gate-trigger voltage vs. gate-trigger current for T2302, T2312 series.

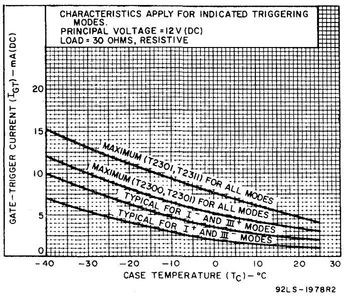


Fig. 13—Gate-trigger current vs. case temperature for T2300, T2301.

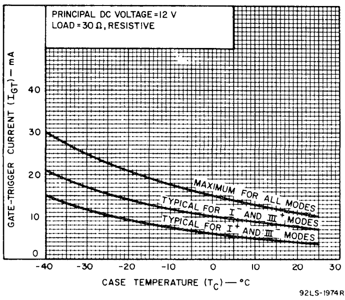


Fig. 14—Gate-trigger current vs. case temperature for T2302, T2312 series.

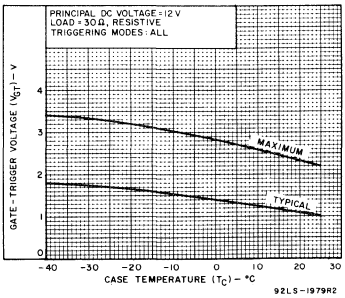


Fig. 15—Gate-trigger voltage vs. case temperature.

T2303 (2N5754-2N5757), T2313 Series

2.5-A Silicon Triacs

Modified TO-5 and Modified TO-5 with Heat Radiator Packages
For AC power Switching Applications

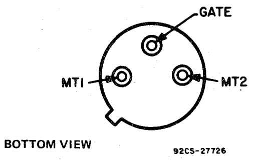
The RCA-T2303 and T2313 series triacs are gate-controlled full-wave silicon ac switches that are designed to switch from an off-state to an on-state for either polarity of applied voltage with positive or negative gate-triggering voltages.

The T2303 (2N5754-57) series types employ a hermetic modified TO-5 package. The T2313 series types employ a hermetic modified TO-5 with a factory-attached heat radiator package.

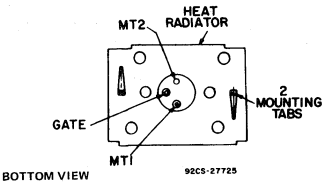
Features:

- Gate sensitivity –25 mA
- di/dt capability –100 A/μs
- Shorted-emitter, center-gate design
- Low switching losses
- Low-on-state voltage at high current levels

TERMINAL CONNECTIONS



T2303 (2N5754–57) Series



T2313 Series

MAXIMUM RATINGS, *Absolute-Maximum Values:*

For operation with sinusoidal supply voltage at frequencies up to 50/60 Hz and with resistive or inductive load

	T2303F T2313F	2N5754 T2313A	2N5755 T2313B	2N5756 T2313D	2N5757 T2313M	
*V_{DROM}▲:						
Gate open, T_J = –65 to 100°C	50	100	200	400	600	V
$I_{T(RMS)}$ (θ = 360°C):						
* T_C = 70°C (T2303 series)			2.5			A
T_A = 25°C (T2313 series)			1.9			A
For other conditions			See Figs. 2,3,4			
I_{TSM}:						
For one cycle of applied principal voltage, at current and temperature shown above for $I_{T(RMS)}$:						
* 60 Hz (sinusoidal)			25			A
50 Hz (sinusoidal)			21			A
For more than one cycle of applied principal voltage			See Figs. 5,6			
di/dt:						
$V_D = V_{DROM}$, I_{GT} = 50 mA, t_r = 0.1 μs			100			A/μs
I^2t [At T_C shown for $I_{T(RMS)}$]:						
t = 20 ms			4.3			A^2s
t = 2.5 ms			2			A^2s
t = 0.5 ms			1			A^2s
For other time values			See Fig. 6			
*I_{GTM}●						
For 1 μs max. (See Fig. 9)			1			A
P_{GM}:						
Peak (For 1 μs max., $I_{GTM} \leqslant$ 1 A (peak), (See Fig. 9)			10			W
*$P_{G(AV)}$ – T_C = 70°C			0.15			W
T_A = 25°C			0.05			W
*T_{stg}■			–65 to 150			°C
*T_C■			–65 to 100			°C
T_T■:						
During soldering for 10 s maximum at distance $\geqslant$ 1/16 in. (1.58 mm) from seating plane			225			°C

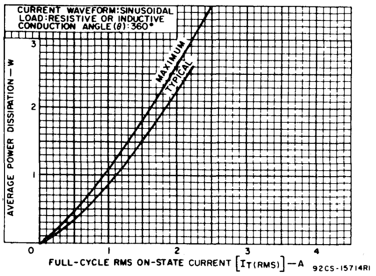


Fig. 1 – Power dissipation vs. on-state current.

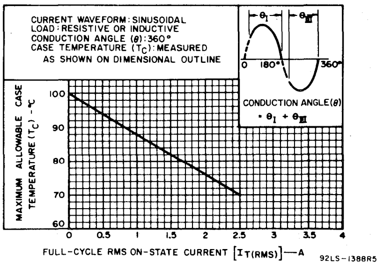


Fig. 2 – Maximum allowable case temperature vs. on-state current.

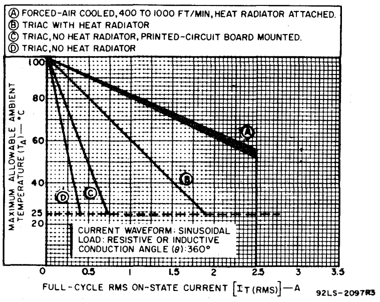


Fig. 3 – Maximum allowable ambient temperature vs. on-state current.

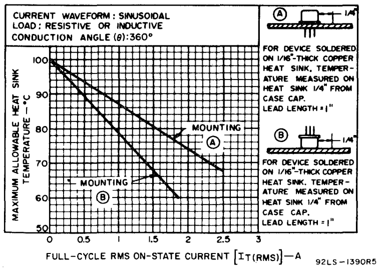


Fig. 4 – Maximum allowable heat-sink temperature vs. on-state current.

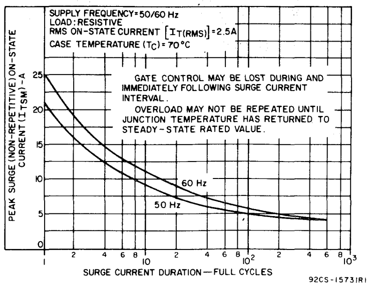


Fig. 5 – Peak surge on-state current vs. surge-current duration.

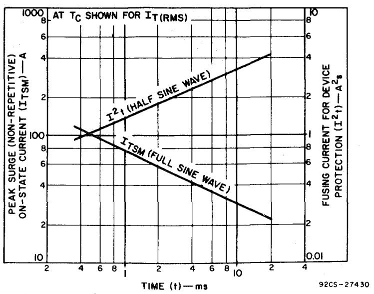


Fig. 6 – Peak surge on-state current and fusing current vs. time.

T2303 (2N5754-2N5757), T2313 Series

ELECTRICAL CHARACTERISTICS, *At Maximum Ratings Unless Otherwise Specified and at Indicated Case Temperature (T_C)*

	CHARACTERISTICS	LIMITS			UNITS
		For All Types Except as Specified			
		MIN.	TYP.	MAX.	
*	I_{DROM}▲:				
	Gate open, T_J = 100°C, V_{DROM} = Max. rated value	—	0.2	0.75	mA
	V_{TM}▲:				
	i_T = 10 A (peak), T_C = 25°C	–	2.2	2.6	V
*	i_T = 3.5 A (peak), T_C = 25°C	–	–	1.8	
	I_{HO}▲: (See Fig. 7)				
	Gate open, Initial principal current = 150 mA (dc), v_D = 12 V				
	T_C = 25°C	–	6	35	mA
	= −65°C	–	20	82*	
	dv/dt (Commutating)▲:				
	$v_D = V_{DROM}$, $I_{T(RMS)}$ = 2.5 A commutating di/dt = 0.95 A/ms, gate unenergized, T_C = 70°C	0.5	–	–	V/µs
*	dv/dt (Off-State)▲:				
	$v_D = V_{DROM}$, exponential voltage rise, gate open, T_C = 100°C:	10	100	–	V/µs
	I_{GT}▲●: (See Fig. 10)				
	v_D = 12 V dc, R_L = 30Ω, T_C = 25°C				
	Mode V_{MT2} V_G				
	I^+ positive positive	–	5	25	
	III^- negative negative	–	5	25	
	I^- positive negative	–	10	40	
	III^+ negative positive	—	10	40	
	v_D = 12 V dc, R_L = 30Ω, T_C = −65°C				mA
	Mode V_{MT2} V_G				
	I^+ positive positive	–	30	60*	
	III^- negative negative	–	30	60*	
	I^- positive negative	–	40	100*	
	III^+ negative positive	–	40	100*	
	V_{GT}▲●: (See Fig. 11)				
	v_D = 12 V dc, R_L = 30Ω, T_C = 25°C	–	0.9	2.2	
	= −65°C	–	1.5	3*	V
	$v_D = V_{DROM}$, R_L = 125Ω, T_C = 100°C	0.2	–	–	
	t_{gt}:				
	$v_D = V_{DROM}$, I_{GT} = 60 mA, t_r = 0.1 µs, i_T = 10 A (peak) T_C = 25°C	–	1.8	2.5	µs
*	$R_{\theta JC}$:				
	Steady-State	–	–	8.5	°C/W
	$R_{\theta JA}$:				
	Steady-State	–	–	150	

* In accordance with JEDEC registration data format (JS-14, RDF-2– filed for the JEDEC (2N-Series) types.

▲ For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.

● For either polarity of gate voltage (V_G) with reference to main terminal 1.

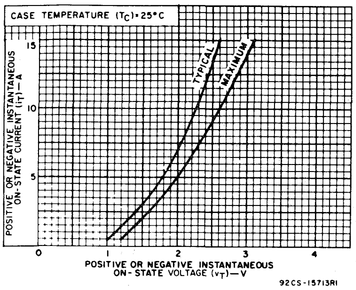


Fig. 7 — On-state current vs. on-state voltage.

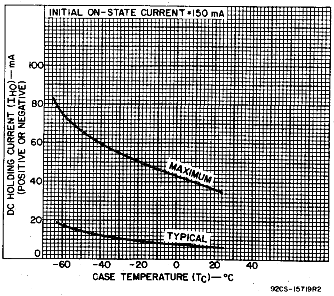


Fig. 8 — DC holding current (positive or negative) vs. case temperature.

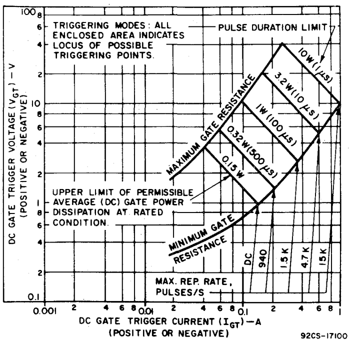


Fig. 9 — Gate-trigger characteristics and limiting conditions for determination of permissible gate-trigger pulses.

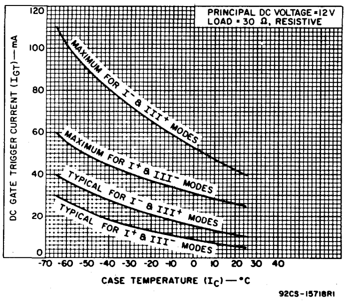


Fig. 10 — DC gate-trigger current vs. case temperature.

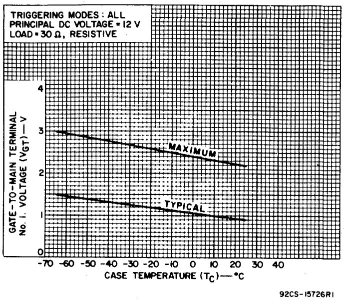


Fig. 11 — DC gate-trigger voltage vs. case temperature.

T2304, T2305 Series

400-Hz, 0.5-A Sensitive-Gate Silicon Triacs

For Control-Systems Application in Airborne and Ground-Support Type Equipment

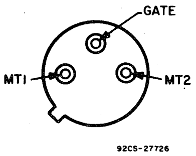
RCA T2304- and T2305-series triacs are gate-controlled full-wave silicon ac switches. They are designed to switch from an off-state to an on-state for either polarity of applied voltage with positive or negative gate triggering voltages.

These triacs are intended for operation up to 400 Hz with resistive or inductive loads and nominal line voltages of 115 and 208 V RMS sine wave and repetitive peak off-stage voltages of 200 V and 400 V.

The high gate sensitivity of these triacs permits the use of economical transistorized or integrated control circuits and enhances their use in low-power phase control and load-switching applications.

Features:
- High gate sensitivity, I_{GT} = 10/40 mA max.
- di/dt capability = 100 A/μs
- Commutating dv/dt capability characterized at 400 Hz
- Shorted-Emitter Design

TERMINAL CONNECTIONS



Modified JEDEC TO-5

MAXIMUM RATINGS, *Absolute-Maximum Values:*

For Operation with Sinusoidal Supply Voltage at Frequencies up to 400 Hz and with Resistive or Inductive Load.

		T2304B T2305B	T2304D T2305D	
REPETITIVE PEAK OFF-STATE VOLTAGE:*				
Gate open, T_J = -50 to 100°C	V_{DROM}	200	400	V
RMS ON-STATE CURRENT (Conduction angle = 360°):	$I_{T(RMS)}$			
Case temperature (T_C) = 90°C		0.5		A
Ambient temperature (T_A) = 25°C, without heat sink		0.4		A
For other conditions		*See Figs. 2 & 3*		
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:	I_{TSM}			
For one cycle of applied principal voltage, T_C = 90°C				
400 Hz (sinusoidal)		50		A
60 Hz (sinusoidal)		25		A
50 Hz (sinusoidal)		21		A
For more than one cycle of applied principal voltage		*See Fig. 4*		
RATE-OF-CHANGE OF ON-STATE CURRENT:	di/dt			
$V_{DM} = V_{DROM}$, I_{GT} = 60 mA, t_r = 0.1 μs		100		A/μs
FUSING CURRENT (for triac protection):				
T_J = -50 to 100°C, t = 1.25 to 10 ms	I^2t	2		A^2s
PEAK GATE-TRIGGER CURRENT:▪	I_{GTM}			
For 1 μs (max.) (*See Fig. 10*)		1		A
GATE POWER DISSIPATION:				
PEAK (For 1 μs max., (*See Fig. 10*)	P_{GM}	10		W
AVERAGE (At T_C = 60°C)	$P_{G(AV)}$	0.15		W
(At T_A = 25°C, without heat sink)	$P_{G(AV)}$	0.05		W
TEMPERATURE RANGE:▲				
Storage	T_{stg}	-50 to 150		°C
Operating (Case)	T_C	-50 to 100		°C
LEAD TEMPERATURE (During soldering):				
At distances ≥ 1/16 in. (1.58 mm) from the case for 10 s max.	T_L	225		°C

* For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.

▪ For either polarity of gate voltage (V_G) with reference to main terminal 1.

▲ For temperature measurement reference point, see Dimensional Outline.

ELECTRICAL CHARACTERISTICS

At Maximum Ratings and at Indicated Case Temperature (T_C) Unless Otherwise Specified

CHARACTERISTIC	SYMBOL	LIMITS						UNITS
		T2304 Series			T2305 Series			
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Peak Off-State Current:♠ Gate open, T_J = 100°C, V_{DROM} = Max. rated value	I_{DROM}	-	0.2	0.75	-	0.2	0.75	mA
Maximum On-State Voltage:♠ For i_T = 10 A (peak), T_C = 25°C	V_{TM}	-	1.7	2.2	-	1.7	2.2	V
DC Holding Current:♠ Gate open, Initial principal current = 150 mA (DC), v_D = 12 V, T_C = 25°C	I_{HO}	-	7	15	-	15	30	mA
For other case temperatures		See Figs. 8 & 9						
Critical Rate-of-Rise of Commutation Voltage:♠ For $v_D = V_{DROM}$, $I_{(T(RMS)}$ = 0.5 A, commutating di/dt = 1.8 A/ms, gate unenergized, T_C = 90°C	dv/dt	1	4	-	1	4	-	V/μs
Critical Rate-of-Rise of Off-Stage Voltage:♠ For $v_D = V_{DROM}$, exponentail voltage rise, gate open, T_C = 100°C	dv/dt	10	100	-	10	100	-	V/μs
DC Gate-Trigger Current:♠ Mode, V_{MT2}, V_G For v_D = 12 V (DC), I^+ positive positive	I_{GT}	-	3.5	10	-	5	25	mA
R_L = 30 Ω, III^- negative negative		-	3.5	10	-	5	25	
T_C = 25°C, I^- positive negative		-	7	10	-	10	40	
III^+ negative positive		-	7	10	-	10	40	
For other case temperatures		See Figs. 11 & 12						
DC Gate-Trigger Voltage:♠† For v_D = 12 V (DC), R_L = 30Ω, T_C = 25°C	V_{GT}	-	1	2.2	-	1	2.2	V
For other case temperatures		See Fig. 13						
For $v_D = V_{DROM}$, R_L = 125Ω, T_C = 100°C		0.15	-	-	0.15	-	-	
Gate-Controlled Turn-On Time: (Delay Time + Rise Time) For $v_D = V_{DROM}$, I_{GT} = 60 mA, t_r = 0.1 μs, i_T = 10 A (peak), T_C = 25°C (See Fig. 16)	t_{gt}	-	1.8	-	2.5	1.8	2.5	μs
Thermal Resistance, Junction-to-Case:	$\theta_{J\text{-}C}$	-	-	8.5	-	-	8.5	°C/W

♠ For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.

† For either polarity of gate voltage (V_G) with reference to main terminal 1.

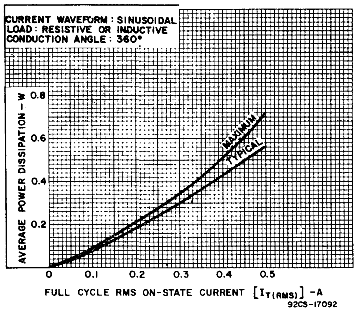


Fig. 1—Power dissipation vs. on-state current.

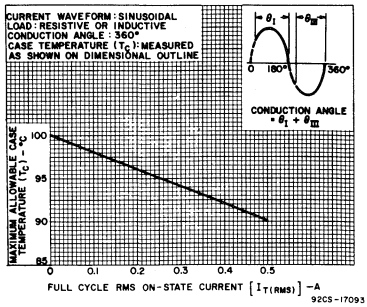


Fig. 2—Maximum allowable case temperature vs. on-state current.

T2304, T2305 Series

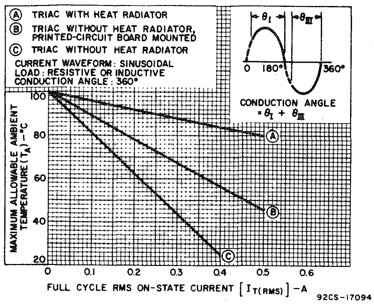


Fig. 3—Maximum allowable ambient temperature vs. on-state current for the package/mounting options of these triacs.

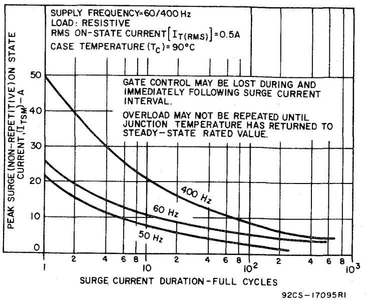


Fig. 4—Peak surge on-state current vs. surge-current duration.

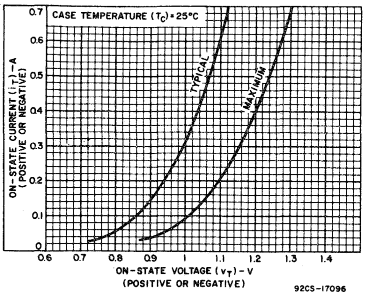


Fig. 5—On-state current vs. on-state voltage (steady-state condition).

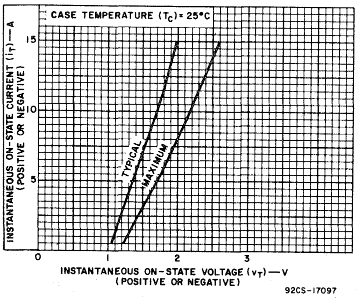


Fig. 6—On-state current vs. on-state voltage (surge condition).

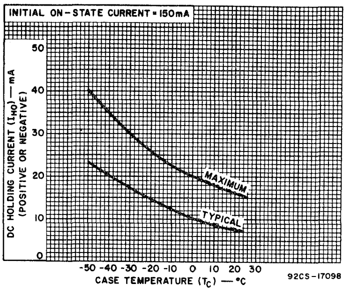


Fig. 7—DC holding current vs. case temperature for T2304 series.

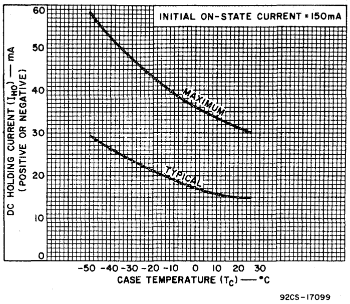


Fig. 8—DC holding current vs. case temperature for T2305 series.

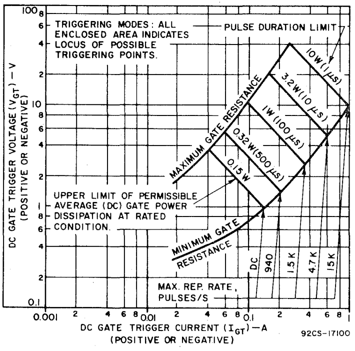


Fig. 9—Gate-trigger characteristics and limiting conditions for determination of permissible gate-trigger pulses.

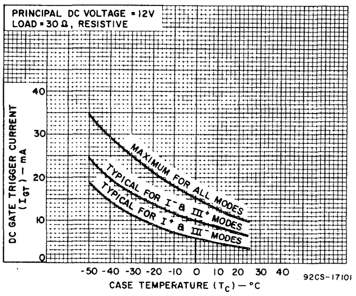


Fig. 10—DC gate-trigger current vs. case temperature for T2304 series.

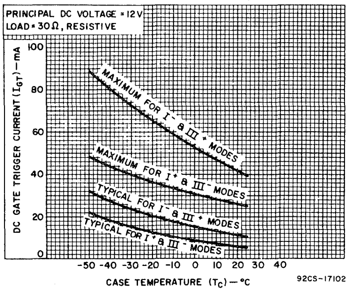


Fig. 11—DC gate-trigger current vs. case temperature for T2305 series.

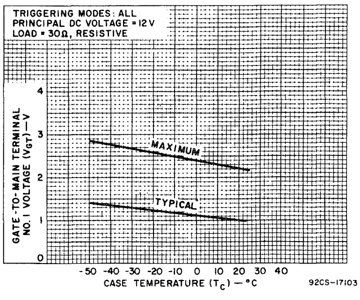


Fig. 12—DC gate-trigger voltage vs. case temperature.

T2500 Series

6-A Silicon Triacs

Three-Lead Plastic Types for Power-Control and Power-Switching Applications

Features:
- 60-A Peak Surge Full-Cycle Current Ratings
- Shorted-Emitter, Center-Gate Design
- Package Design Facilitates Mounting on a Printed-Circuit Boa
- Low Switching Losses
- Low Thermal Resistance

Types T2500B and T2500D* are gate-controlled full-wave silicon triacs utilizing a plastic case with three leads to facilitate mounting on printed-circuit boards. They are intended for the control of ac loads in such applications as motor controls, heating controls, relay replacement, solenoid drivers, static switching, and power-switching systems.

These devices are designed to switch from an off-state to an on-state for either polarity of applied voltage with positive or negative gate triggering voltages. They have an on-state current rating of 6 amperes at a T_C of 80°C and repetitive off-state voltage ratings of 200 volts and 400 volts, respectively.

These triacs employ the plastic JEDEC TO-220-AB package.

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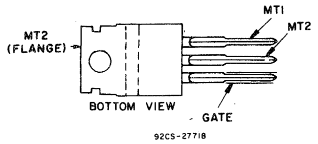
*Formerly RCA Dev. Nos. TA8504 and TA8505.

TERMINAL CONNECTIONS



JEDEC TO-220AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*
For Operation with Sinusoidal Supply Voltage at Frequencies up to 50/60 Hz and with Resistive or Inductive Load.

		T2500B	T2500D	
REPETITIVE PEAK OFF-STATE VOLTAGE:●				
Gate open, T_J = –65 to 100°C	V_{DROM}	200	400	V
RMS ON-STATE CURRENT (Conduction angle = 360°):				
Case temperature	$I_{T(RMS)}$			
T_C = 80°C		6		A
For other conditions		*See Fig. 2*		
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:				
For one cycle of applied principal voltage, T_C = 80°C	I_{TSM}			
60 Hz (sinusoidal)		60		A
50 Hz (sinusoidal)		50		A
For more than one cycle of applied principal voltage		*See Fig. 3*		
RATE OF CHANGE OF ON-STATE CURRENT:				
$V_{DM} = V_{DROM}$, I_{GT} = 200 mA, tr = 0.1 µs	di/dt	70		A/µs
FUSING CURRENT (for Triac Protection):				
T_C = –65 to 100°C, t = 1.25 to 10 ms	I^2t	18		A^2s
PEAK GATE-TRIGGER CURRENT:■				
For 10 µs max; see *Fig. 10*	I_{GTM}	4		A
GATE POWER DISSIPATION:				
Peak (For 1 µs max., $I_{GTM} \leq 4$ A; see *Fig. 6*)	P_{GM}	16		W
AVERAGE	$P_{G(AV)}$	0.2		W
TEMPERATURE RANGE:▲				
Storage	T_{stg}	–65 to 150		°C
Operating (Case)	T_C	–65 to 100		°C
TERMINAL TEMPERATURE (During soldering):				
For 10 s max. (terminals and case)	T_T	225		°C

● For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.
■ For either polarity of gate voltage (V_G) with reference to main terminal 1.
▲ For temperature measurement reference point, see *Dimensional Outline.*

ELECTRICAL CHARACTERISTICS at Maximum Ratings unless otherwise specified, and at indicated Case Temperature (T_C)

CHARACTERISTIC	SYMBOL	LIMITS						UNITS
		T2500B			T2500D			
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
Peak Off-State Current:* Gate Open, V_{DROM} = Max. rated value At T_J = 100°C	I_{DROM}	–	0.1	2	–	0.1	2	mA
Maximum On-State Voltage:* For i_T = 30 A (peak) and T_C = 25 °C	v_{TM}	–	1.7	2	–	1.7	2	V
DC Holding Current:* Gate Open Initial principal current = 150 mA (dc) At T_C = 25 °C	I_{HO}	–	15	30	–	15	30	mA
For other case temperatures		See Fig.5.						
Critical Rate of Rise of Commutation Voltage:*♦ For $v_D = V_{DROM}$, $I_{T(RMS)}$ = 6 A, Commutating di/dt = 3.2 A/ms, and gate unenergized At T_C = 80°C	dv/dt	4	10	–	4	10	–	V/µs
Critical Rate of Rise of Off-State Voltage:* For $v_D = V_{DROM}$, exponential voltage rise, and gate open At T_C = 100°C	dv/dt	100	300	–	75	250	–	V/µs
For other case temperatures		See Fig.9						
DC Gate-Trigger Current:*† For v_D = 12V (dc), R_L = 12 Ω T_C = 25 °C, and specified triggering mode: I^+ Mode (V_{MT2} positive, V_G positive)	I_{GT}	–	10	25	–	10	25	mA
III^- Mode (V_{MT2} negative, V_G negative)		–	15	25	–	15	25	
I^- Mode (V_{MT2} positive, V_G negative)		–	20	60	–	20	60	
III^+ Mode (V_{MT2} negative, V_G positive)		–	30	60	–	30	60	
For other case temperatures		See Figs. 7 and 8.						

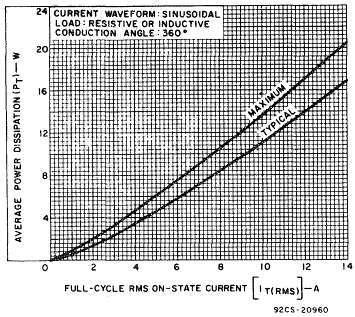


Fig. 1—Power dissipation vs. on-state current.

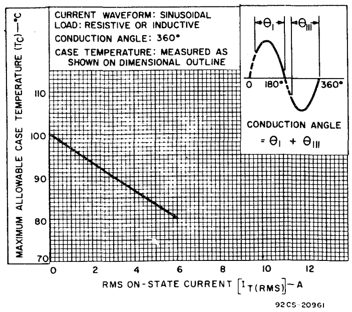


Fig. 2—Allowable case temperature vs. on-state current.

T2500 Series

ELECTRICAL CHARACTERISTICS at Maximum Ratings unless otherwise specified, and at indicated Case Temperature (T_C)

CHARACTERISTIC	SYMBOL	LIMITS						UNITS
		T2500B			T2500D			
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
DC Gate-Trigger Voltage:*† For v_D = 12 V (dc) and R_L = 12 Ω At T_C = 25 °C	V_{GT}	–	1.25	2.5	–	1.25	2.5	V
For other case temperatures		See Fig.9						
For v_D = V_{DROM} and R_L = 125 Ω At T_C = 100 °C		0.2	–	–	0.2	–	–	
Gate-Controlled Turn-On Time (Delay Time + Rise Time): For v_D = V_{DROM}, I_{GT} = 160 mA, rise time = 0.1 μs, and i_T = 10 A (peak) At T_C = 25°C See *Fig. 11*	t_{gt}	–	1.6	2.5	–	1.6	2.5	μs
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$	–	–	2.7	–	–	2.7	°C/W
Junction-to-Ambient	$R_{\theta JA}$	–	–	60	–	–	60	°C/W

*For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.

†For either polarity of gate voltage (V_G) with reference to main terminal 1.

♦Variants of these devices having dv/dt characteristics selected specifically for inductive loads are available on special order; for additional information, contact your RCA Representative or your RCA Distributor.

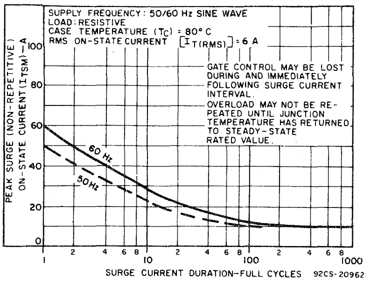


Fig. 3—Peak surge on-state current vs. surge-current duration.

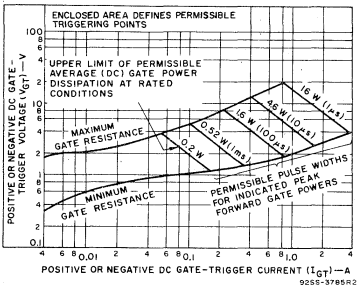


Fig. 6—Gate-pulse characteristics for all triggering modes.

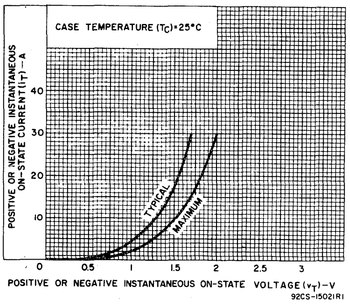


Fig. 4—On-state current vs. on-state voltage.

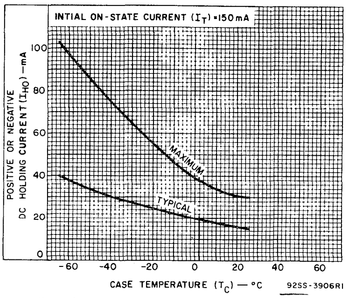


Fig. 5—DC holding current for either direction of on-state current vs. case temperature.

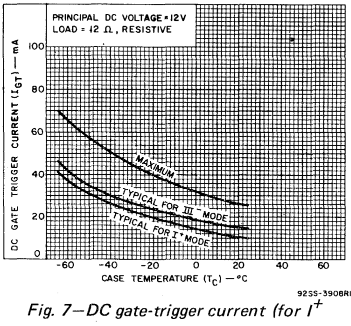


Fig. 7—DC gate-trigger current (for I^+ and III^- triggering modes) vs. case temperature.

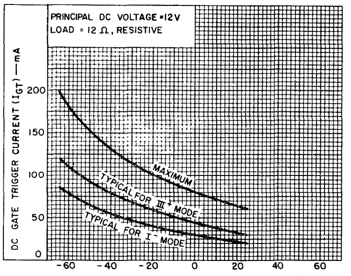


Fig. 8—DC gate-trigger current (for I^- and III^+ triggering modes) vs. temperature.

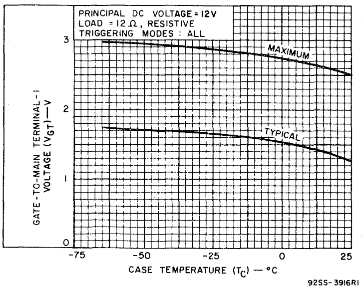


Fig. 9—DC gate-trigger voltage vs. case temperature.

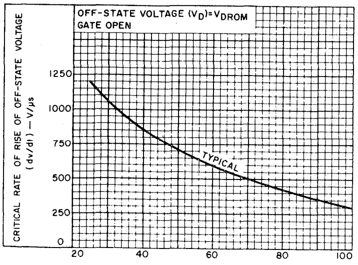


Fig. 10—Critical rate of rise of off-state voltage vs. case temperature.

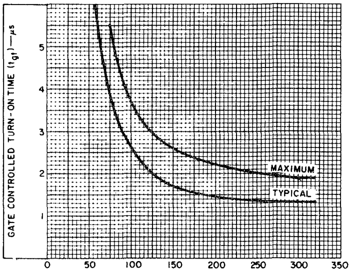


Fig. 11—Typical turn-on time vs. gate-trigger current.

T2700, T2710 Series

6-A Silicon Triacs

For Power-Control and Power-Switching Applications

RCA T2700- and T2710-series devices are gate-controlled full-wave silicon triacs. They are intended for the control of ac loads in applications such as heating controls, motor controls, light dimmers, and power switching systems.

These triacs are designed to switch from an off-state to an on-state condition for either polarity of applied voltage with positive or negative triggering voltages to the gate.

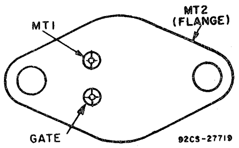
Features:

- **Shorted-emitter construction ... contains an internally diffused resistor between gate and Main Terminal 1**
- **Center gate construction . . . provides rapid uniform gate-current spreading for faster turn-on with substantially reduced heating effects**

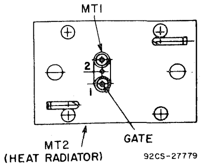
T2700B and T2700D are hermetically sealed types having an on-state current rating of 6 amperes at a case temperature of +75°C and repetitive off-state voltage ratings of 200 volts and 400 volts, respectively.

The T2700 series types employ the hermetic JEDEC TO-66 package. The T2710 series employ the hermetic TO-66 with a factory attached heat-radiator package.

TERMINAL CONNECTIONS



JEDEC TO-66



JEDEC TO-66 With Heat Radiator

Maximum Ratings, Absolute-Maximum Values:

For Operation with Sinusoidal Supply Voltage at Frequencies of 50/60 Hz, and with Resistive or Inductive Load

	T2700B T2710B	T2700D T2710D	
REPETITIVE PEAK OFF-STATE VOLTAGE♦, V_{DROM}:			
Gate Open, For T_J = − 65 to + 100 °C	200	400	V
RMS ON-STATE CURRENT, $I_{t(rms)}$:			
For case temperature (T_C) of +75 °C and a conduction angle of 360°	6	6	A
For ambient temperatures (T_A) up to + 100 °C and a conduction angle of 360°	See Fig. 3.		
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT, I_{TSM}:			
For one cycle of applied principal voltage, T_C = 75°C			
60 Hz (sinusoidal)	100	100	A
50 Hz (sinusoidal)	85	85	A
For more than one full cycle of applied voltage	See Fig. 4.		
RATE OF CHANGE OF ON-STATE CURRENT:			
V_{DM} = V_{DROM}, I_{GT} = 200 mA, tr = 0.1 μs di/dt	100		A/μs
FUSING CURRENT (for triac protection, I^2t:			
T_J = −65 to 100°C, t = 1.25 to 10 ms	50	50	A^2s
PEAK GATE-TRIGGER CURRENT■, I_{GTM}:			
For 1 μs max.	4	4	A
GATE POWER DISSIPATION:■			
PEAK, P_{GM} For 1 μs max. and $I_{GTM} \leq 4$ A (peak).	16	16	W
AVERAGE, $P_{G(AV)}$	0.2	0.2	W
TEMPERATURE RANGEϕ:			
Storage	−65 to + 150		°C
Operating (case)	−65 to + 100		°C

♦For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.

■For either polarity of gate voltage (V_{GT}) with reference to main terminal 1.

ϕFor information on the reference point of temperature measurement, see *Dimensional Outline*.

ELECTRICAL CHARACTERISTICS

At Maximum Ratings and at Indicated Case Temperature (T_C) Unless Otherwise Specified

(For Definitions of Terms and Symbols, See Page 6)

CHARACTERISTIC	SYMBOL	LIMITS												UNITS
		T2700B			T2710B			T2700D			T2710D			
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Peak Off-State Current:* Gate Open At T_J = + 100 °C and V_{DROM} = Max. rated value	I_{DROM}	–	0.1	4	–	0.1	1.2	–	0.2	4	–	0.2	1.2	mA
Maximum On-State Voltage:* For i_T = 30A (peak) and T_C = +25 °C	v_{TM}	–	1.8	2.25	–	1.8	2.25	–	1.8	2.25	–	1.8	2.25	V
DC Holding Current:* Gate Open Initial principal current = 150 mA (DC) At T_C = +25 °C	I_{HO}	–	15	30	–	15	30	–	15	30	–	15	30	mA
For other case temperatures		See Fig. 6.												
Critical Rate of Rise of Commutation Voltage:*♦ For V_D = V_{DROM}, $I_{t(rms)}$ = 6 A, commutating di/dt = 3.2 A/ms, and gate unenergized At T_C = +75 °C	dv/dt	3	10	–	–	–	–	3	10	–	–	–	–	V/μs
$I_{t(rms)}$ and T_A specified by curve A of Fig. 3.		–	–	–	3	10	–	–	–	–	3	10	–	
$I_{t(rms)}$ and T_A specified by curve B of Fig. 3		–	–	–	4	12	–	–	–	–	4	12	–	
Critical Rate of Rise of Off-State Voltage:* For V_D = V_{DROM}, exponential voltage rise, and gate open At T_C = + 100 °C	dv/dt	30	150	–	30	150	–	20	100	–	20	100	–	V/μs
DC Gate-Trigger Current:*† For V_D = 12 volts (DC), R_L = 12 Ω T_C = +25 °C, and specified triggering mode:	I_{GT}													mA
I+ Mode: positive V_{MT2}, positive V_{GT}		–	15	25	–	15	25	–	15	25	–	15	25	
III− Mode: negative V_{MT2}, negative V_{GT}		–	15	25	–	15	25	–	15	25	–	15	25	
I− Mode: positive V_{MT2}, negative V_{GT}		–	25	40	–	25	40	–	25	40	–	25	40	
III+ Mode: negative V_{MT2}, positive V_{GT}		–	25	40	–	25	40	–	25	40	–	25	40	
For other case temperatures		See Fig. 8 & 9.												
DC Gate-Trigger Voltage:*† For V_D = 12 volts (DC) and R_L = 12 Ω At T_C = +25 °C	V_{GT}	–	1	2.2	–	1	2.2	–	1	2.2	–	1	2.2	V
For other case temperatures		See Fig. 10.												
For V_D = V_{DROM} and R_L = 125 Ω At T_C = + 100 °C		0.2	–	–	0.2	–	–	0.2	–	–	0.2	–	–	

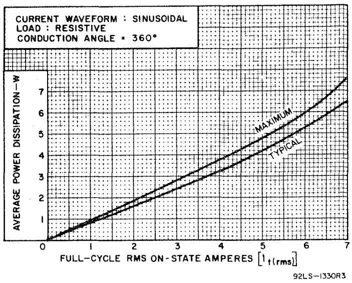


Fig. 1—Power dissipation vs. on-state current.

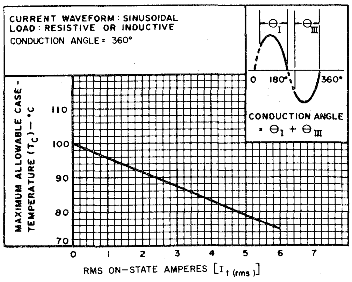


Fig. 2—Allowable case temperature vs. on-state current.

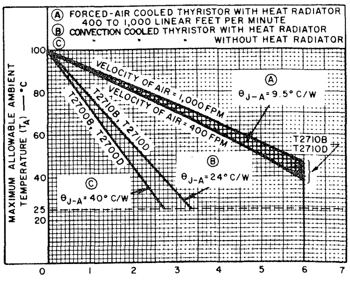


Fig. 3—Maximum allowable ambient temperature vs. on-state current.

T2700, T2710 Series

ELECTRICAL CHARACTERISTICS

At Maximum Ratings and at Indicated Case Temperature (T_C) Unless Otherwise Specified
(For Definitions of Terms and Symbols, See Page 6)

CHARACTERISTIC	SYMBOL	LIMITS												UNITS
		T2700B			T2710B			T2700D			T2710D			
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Gate-Controlled Turn-On Time: (Delay Time + Rise Time) For $V_D = V_{DROM}$ and $I_{GT} = 80$ mA, 0.1 μs rise time, and $i_T = 10$ A (peak) At $T_C = +25\,^{\circ}C$	t_{gt}	–	2.2	–	–	2.2	–	–	2.2	–	–	2.2	–	μs
Thermal Resistance:														
Junction-to-Case (Steady-State)	$\theta_{J\text{-}C}$	–	–	4	–	–	–	–	–	4	–	–	–	°C/W
Junction-to-Case (Transient)	$\theta_{J\text{-}C}$	See Fig. 11.												°C/W
Junction-to-Ambient	$\theta_{J\text{-}A}$	–	–	–	See Fig. 3.			–	–	–	See Fig. 3.			°C/W

*For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.

†For either polarity of gate voltage (V_{GT}) with reference to main terminal 1.

♦Variants of these devices having dv/dt characteristics selected specifically for inductive loads are available on special order; for additional information, contact your RCA Representative or your RCA Distributor.

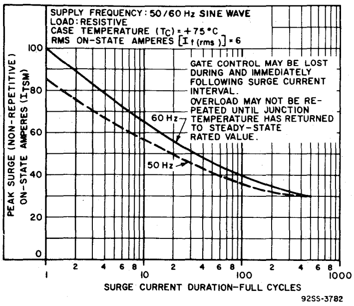


Fig. 4—Peak surge on-state current vs. surge-current duration.

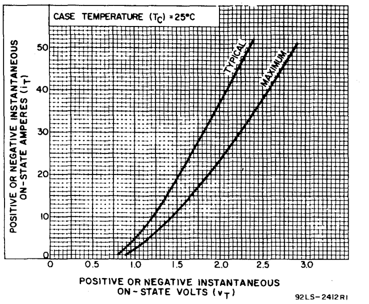


Fig. 5—On-state current vs. on-state voltage.

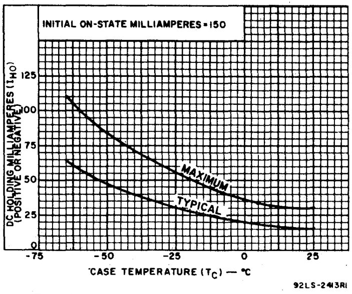


Fig. 6—DC holding current for either direction of on-state current vs. case temperature.

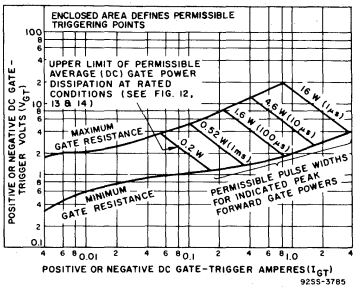


Fig. 7—Gate-pulse characteristics for all triggering modes.

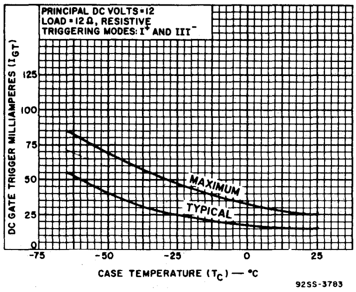


Fig. 8—DC gate-trigger current (for I^+ and III^- triggering modes) vs. case temperature.

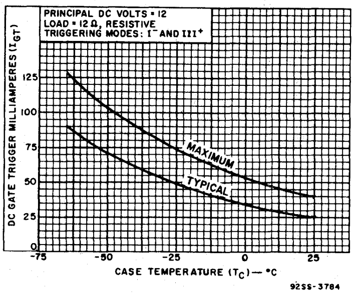


Fig. 9—DC gate-trigger current (for I^- and III^+ triggering modes) vs. case temperature.

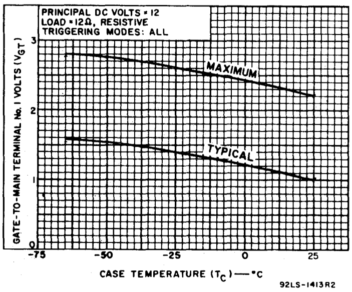


Fig. 10—DC gate-trigger voltage vs. case temperature.

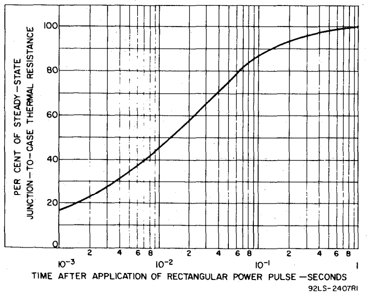


Fig. 11—Transient thermal resistance (junction-to-case vs. time).

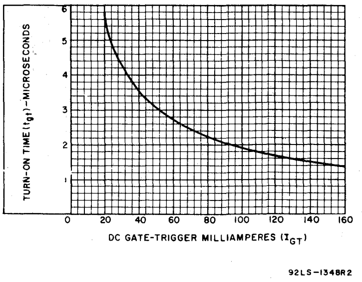


Fig. 12—Typical turn-on time vs. gate-trigger current.

T2800, T2801, T2802 , T2850 Series

6-A and 8-A Silicon Triacs

Three-Lead Plastic ı ypes for Power-Control and Power-Switching Applications

These RCA triacs are gate-controlled full-wave silicon switches utilizing a plastic case with three leads to facilitate mounting on printed-circuit boards. They are intended for the control of ac loads in such applications as motor controls, light dimmers, heating controls, and power-switching systems.

These devices are designed to switch from an off-state to an on-state for either polarity of applied voltage with positive or negative gate triggering voltages.

The T2801 and T2802 series triacs are characterized for I^+, III^- gate triggering modes only and should suit a wide range of applications that employ diac or anode on/off triggering.

All series employ the plastic JEDEC TO-220AB package. The T2850-series package has three leads that are electrically isolated from the mounting flange. Because of this internal isolation, the triac can be mounted directly on a heat sink, without any insulating hardware; therefore heat transfer is improved and heat-sink size can be reduced.

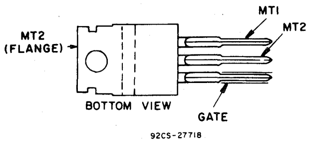
Features:

- **80-A and 100-A Peak Surge Full-Cycle Current Ratings**
- **Glass Passivated Junctions**
- **Short-Emitter Center-Gate Design**
- **Low Switching Losses**
- **Low Thermal Resistance**
- **Package Design Facilitates Mounting on a Printed-Circuit Board**

Additional Features for T2850 Series:

- **Internal Isolation**
- **Package Suitable for Direct Mounting on Heat Sink**

TERMINAL CONNECTIONS



JEDEC TO-220AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*
For Operation with Sinusoidal-Supply Voltage at Frequencies up to 50/60 Hz and with Resistive or Inductive Load.

		–	T2800B	T2800C	T2800D	T2800E	T2800M	
		–	T2802B	T2802C	T2802D	T2802E	T2802M	
		–	T2801B	T2801C	T2801D	T2801E	–	
		T2850A	T2850B	–	T2850D	–	–	
REPETITIVE PEAK OFF-STATE VOLTAGE:●								
Gate open, $T_J = -65$ to 100°C	V_{DROM}	100	200	300	400	500	600	V
RMS ON-STATE CURRENT (Conduction angle = 360°):	$I_{T(RMS)}$							
Case Temperature								
T_C = 80°C (T2800, T2802, T2850 series)		8						A
= 80°C (T2801 series only)		6						A
For other conditions		See Fig. 3						
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:	I_{TSM}							
For one cycle of applied principal voltage								
60 Hz (sinusoidal), T_C=80° C (T2800, T2802, T2850 series)		100						A
50 Hz (sinusoidal) T_C=80° C (T2800, T2802, T2850 series)		85						A
60 Hz (sinusoidal), T_C=80°C (T2801 series only)		80						A
50 Hz (sinusoidal), T_C=80°C (T2801 series only)		65						A
For more than one cycle of applied principal voltage		See Fig. 4, 5						
RATE OF CHANGE OF ON-STATE CURRENT:								
$v_D = V_{DROM}$, I_{GT} = 200 mA, t_r = 0.1 µs	di/dt	70						A/µs
FUSING CURRENT (for triac protection):								
At T_C shown for $I_{T(RMS)}$:								
t = 20 ms								
T2800, T2802, T2850		55						A^2s
T2801		35						A^2s
= 2.5 ms								
T2800, T2802, T2850		28						A^2s
T2801		18						A^2s
= 0.5 ms								
T2800, T2802, T2850		16						A^2s
T2801		10						A^2s
PEAK GATE-TRIGGER CURRENT:■								
For 1 µs max. **See Fig. 11**	I_{GTM}	4						A
GATE POWER DISSIPATION:								
Peak (for 1 µs max., $I_{GTM} \leqslant 4$ A, See Fig. 11	P_{GM}	16						W
AVERAGE (T2800, T2802, T2802 series)	$P_{G(AV)}$	0.35						W
AVERAGE (T2850 series)	$P_{G(AV)}$	0.2						W
TEMPERATURE RANGE:▲								
Storage	T_{stg}	–65 to 150						°C
Operating (Case)	T_C	–65 to 100						°C
TERMINAL TEMPERATURE (During soldering):								
For 10 s max. (*terminals and case*)	T_T	225						°C

●For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.
■For either polarity of gate voltage (V_G) with reference to main terminal 1.
▲For temperature measurement reference point, see Dimensional Outline.

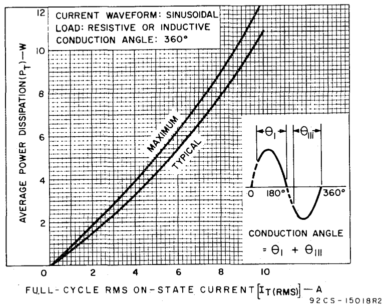


Fig. 1 — Power dissipation vs. on-state current for T2800, T2802, T2850 series.

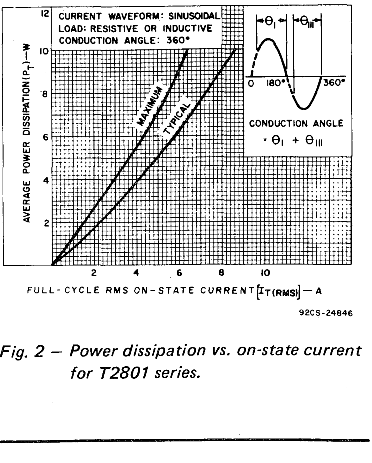


Fig. 2 — Power dissipation vs. on-state current for T2801 series.

T2800, T2801, T2802 , T2850 Series

ELECTRICAL CHARACTERISTICS, *At Maximum Ratings Unless Otherwise Specified, and at Indicated Temperature*

CHARACTERISTICS	SYMBOL	LIMITS For All Types Except as Specified MIN.	TYP.	MAX.	UNITS
Peak Off-State Current:●					
Gate open, T_J = 100°C, V_{DROM} = Max. rated value	I_{DROM}	–	0.1	2	mA˙
Maximum On-State Voltage:● (See Fig. 6, 7)					
For i_T = 30 A (peak), T_C = 25°C (T2800, T2802, T2850 series	v_{TM}	–	1.7	2	V
(T2801 series)		–	2	3	
DC Holding Current:●					
Gate open, Initial principal current = 150 mA (dc)					
v_D = 12 V, T_C = 25°C, T2800, T2850 series		–	15	30	
T2801 series	I_{HO}	–	100	–	mA
T2802 series		–	20	60	
For other case temperatures		See Fig. 8, 9, 10			
Critical Rate-of-Rise of Commutation Voltage:●▲					
For v_D = V_{DROM}, $I_{T(RMS)}$ = 8 A, commutating di/dt = 4.3 A/ms, gate unenergized, T_C = 80°C (T2800, T2802, T2850 series)	dv/dt	4	10	–	V/μs
For v_D = V_{DROM}, $I_{T(RMS)}$ = 6 A, commutating di/dt = 4.3 A/ms, gate unenergized, T_C = 80°C (T2801 series)		2	10	–	
Critical Rate-of-Rise of Off-State Voltage:●					
For v_D = V_{DROM}, exponential voltage rise, gate open, T_C = 100°C:					
T2850A		125	350	–	
T2800B, T2802B, T2850B		100	300	–	
T2800C, T2802C		85	275	–	
T2800D, T2802D, T2850D		75	250	–	
T2800E, T2802E	dv/dt	65	225	–	V/μs
T2800M, T2802M		60	200	–	
T2801B		50	300	–	
T2801C		40	275	–	
T2801D		30	250	–	
T2801E		20	225	–	
DC Gate-Trigger Current:●■					
For v_D = 12 V (dc) R_L = 12Ω T_C = 25°C					
Mode V_{MT2} V_G					
I^+ positive positive T2800, T2850 series		–	10	25	
T2801 series		–	25	80	
T2802 series	I_{GT}	–	25	50	mA
III^- negative negative T2800, T2850 series		–	15	25	
T2801 series		–	25	80	
T2802 series		–	25	50	
I^- positive negative T2800, T2850 series only		–	20	60	
III^+ negative positive T2800, T2850 series only		–	30	60	
For other case temperatures		See Fig. 12, 13, 14			
DC Gate-Trigger Voltage: ●■					
For v_D = 12 V (dc), R_L = 12Ω, T_C = 25°C					
T2800, T2802, T2850 series	V_{GT}	–	1.25	2.5	V
T2801 series		–	1.5	4	
For other case temperatures		See Fig. 15, 16			
For v_D = V_{DROM}, R_L = 125Ω, T_C = 100°C		0.2	–	–	
Gate-Controlled Turn-On Time:					
(Delay Time + Rise Time)					
For v_D = V_{DROM}, I_{GT} = 80 mA, t_r = 0.1 μs,					
i_T = 10 A (peak), T_C = 25°C (T2800, T2802, T2850 series)	t_{gt}	–	1.6	2.5	μs
(T2801 series)		–	2.2	–	
Thermal Resistance:					
Junction-to-Case (T2800, T2801, T2802 series)	$R_{\theta JC}$	–	–	2.2	°C/W
(T2850 series)		–	–	3.1	
Junction-to-Ambient	$R_{\theta JA}$	–	–	60	

● For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.
■ For either polarity of gate voltage (V_G) with reference to main terminal 1.
▲ Variants of these devices having dv/dt characteristics selected specifically for inductive loads are available on special order; for additional information, contact your RCA Representative or your RCA Distributor.

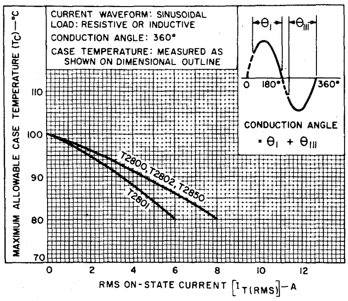


Fig. 3 — Maximum allowable case temperature vs. on-state current.

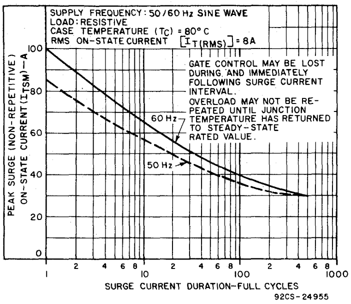


Fig. 4 — Peak surge on-state current vs. surge current duration for T2800, T2802, T2850 series.

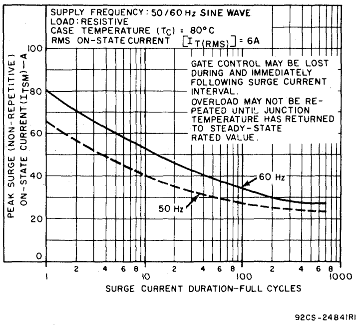


Fig. 5 — Peak surge on-state current vs. surge current duration for T2801 series.

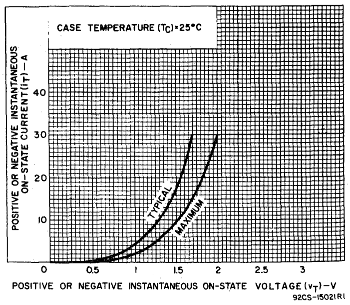


Fig. 6 — On-state current vs. on-state voltage for T2800, T2802, T2850 series.

T2800, T2801, T2802 , T2850 Series

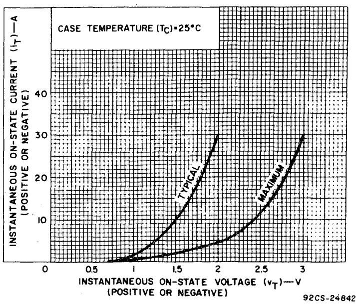


Fig. 7 – On-state current vs. on-state voltage for T2801 series.

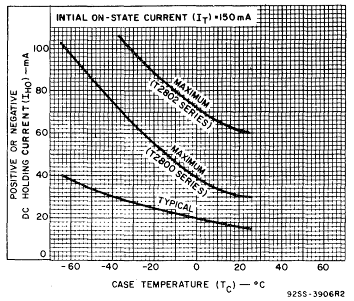


Fig. 8 – DC holding current vs. case temperature for T2800, T2802.

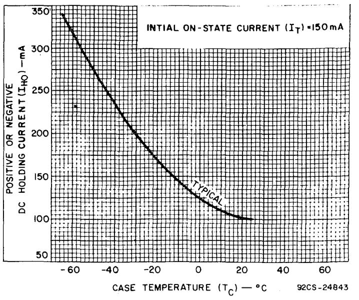


Fig. 9 – DC holding current vs. case temperature for T2801 series.

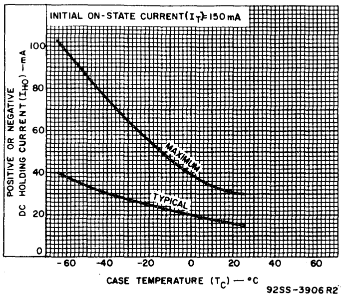


Fig. 10 – DC holding current vs. case temperature for T2850 series.

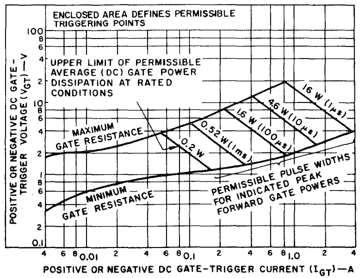


Fig. 11 – Gate pulse characteristics for all triggering modes for all series.

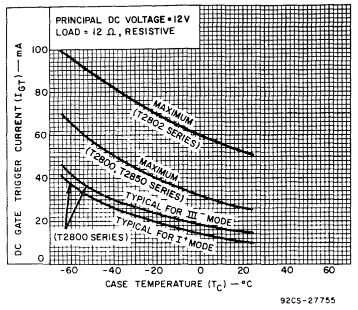


Fig. 12 – DC gate-trigger current (for 1$^+$ and III$^-$ triggering modes) vs. case temperature for T2800, T2802,T2850 series.

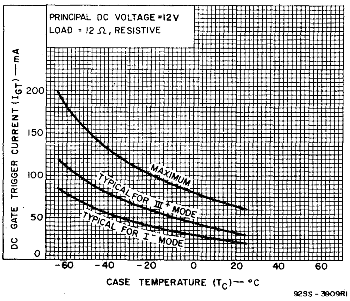


Fig. 13 – DC gate-trigger current (for 1$^-$ and III$^+$ triggering modes) vs. case temperature for T2800, T2802, T2850 series.

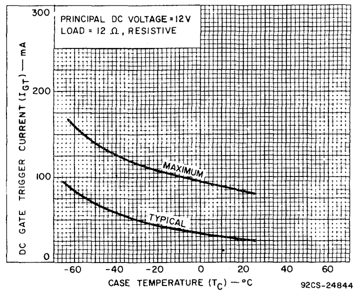


Fig. 14 – DC gate-trigger current (for 1$^+$ and III$^-$ triggering modes) vs. case temperature for T2801 series.

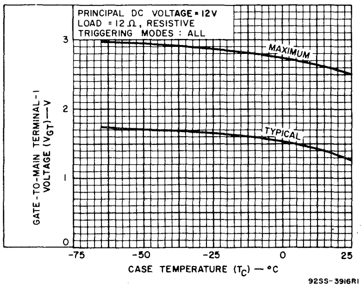


Fig. 15 – DC gate-trigger voltage vs. case temperature for T2800, T2802, T2850 series.

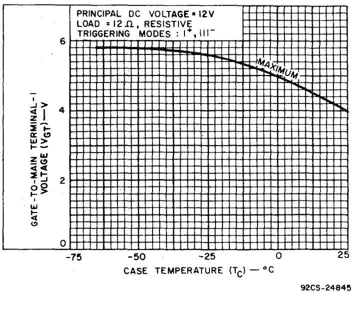


Fig. 16 – DC gate-trigger voltage vs. case temperature for T2801 series.

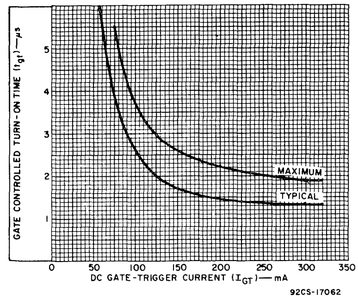


Fig. 17 – Turn-on time vs. gate-trigger current for T2800, T2802, T2850 series.

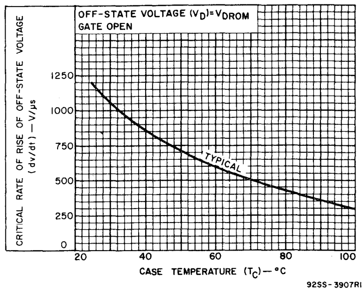


Fig. 18 – Typical critical rate-of-rise of off-state voltage vs. case temperature for all series.

T4100 (2N5567-2N5570, T4100M); T4101 (2N5571-2N5574, T4101M) Series

10-A and 15-A Silicon Triacs

For General Purpose AC Power Switching

Features:

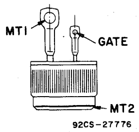
- di/dt Capability = 150 A/μs
- Shorted-Emitter, Center-Gate Design
- Low Switching Losses
- Low On-State Voltage at High Current Levels
- Low Thermal Resistance

These RCA triacs are gate-controlled, full-wave silicon ac switches. They are designed to switch from an off-state to an on-state for either polarity of applied voltage with positive or negative gate triggering voltages.

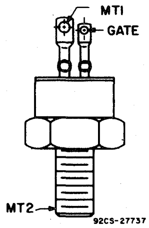
These triacs are intended for control of ac loads in applications such as heating controls, motor controls, arc-welding equipment, light dimmers, and power switching systems.

Types 2N5567, 2N5568, 2N5571, 2N5572, T4100M, and T4101M employ a press-fit package. Types 2N5569, 2N5570, 2N5573, 2N5574, T4110M, T4111M employ a stud package. Types T4120B, T4120D, T4120M, T4121B, T4121D, and T4121M employ an isolated-stud package.

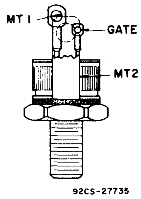
TERMINAL CONNECTIONS



Press-Fit Types



Stud Types



Isolated-Stud Types

MAXIMUM RATINGS, *Absolute-Maximum Values:*
For Operation with Sinusoidal Supply Voltage at Frequencies up to 50/60 Hz and with Resistive or Inductive Load.

		2N5567 2N5569 2N5571 2N5573 T4120B T4121B	2N5568 2N5570 2N5572 2N5574 T4120D T4121D	T4100M T4110M T4120M T4101M T4111M T4121M	
*REPETITIVE PEAK OFF-STATE VOLTAGE:●					
Gate open, T_J = −65 to 100°C	V_{DROM}	200	400	600	V
*RMS ON-STATE CURRENT (Conduction angle = 360°):					
Case temperature	$I_{T(RMS)}$				
T_C = 85°C (2N5567, 68, 69, 70, T4101M, T4111M, T4121B, D, M)		10			A
= 80°C (2N5571, 72, 73, 74, T4100M, T4110M Press-fit & stud types)		15			A
= 75°C (T4120B, D, M – Isolated-stud types)		15			A
For other conditions		See Fig. 3, 4			
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:	I_{TSM}				
For one cycle of applied principal voltage, T_C as above					
* 60 Hz (sinusoidal)		100			A
50 Hz (sinusoidal)		85			A
For more than one cycle of applied principal voltage		See Fig. 5, 6			
RATE-OF-CHANGE OF ON-STATE CURRENT:					
$V_{DM} = V_{DROM}$, I_{GT} = 160 mA, t_r = 0.1 μs	di/dt	150			A/μs
FUSING CURRENT (for Triac Protection):					
At T_C shown for $I_{T(RMS)}$	I^2t				
t = 20 ms		55			A^2s
= 2.5 ms		28			A^2s
= 0.5 ms		16			A^2s
PEAK GATE-TRIGGER CURRENT:■					
For 1 μs max., See Fig. 11	I_{GTM}	4			A
*GATE POWER DISSIPATION:					
PEAK (For 1 μs max., $I_{GTM} \leqslant 4$ A, See Fig. 11	P_{GM}	16			W
AVERAGE	$P_{G(AV)}$	0.5			W
*TEMPERATURE RANGE:▲					
Storage	T_{stg}	−65 to 150			°C
Operating (Case)	T_C	−65 to 100			°C
*TERMINAL TEMPERATURE (During soldering):					
For 10 s max. (terminals and case)	T_T	225			°C
STUD TORQUE:	τ_s				
Recommended		35			in-lb
Maximum (DO NOT EXCEED)		50			in-lb

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* In accordance with JEDEC registration data format (JS-14, RDF 2) filed for the JEDEC (2N-Series) types.

● For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.

■ For either polarity of gate voltage (V_G) with reference to main terminal 1.

▲ For temperature measurement reference point, see Dimensional Outline.

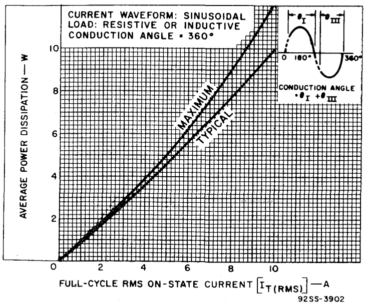


Fig. 1 – Power dissipation vs. on-state current for all 10-A triacs.

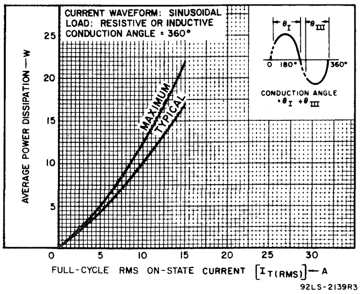


Fig. 2 – Power dissipation vs. on-state current for all 15-A triacs.

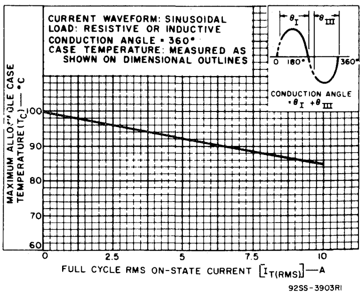


Fig. 3 – Maximum allowable case temperature vs. on-state current for all 10-A triacs.

T4100 (2N5567-2N5570 T4100M); T4101 (2N5571-2N5574 , T4101M) Series

ELECTRICAL CHARACTERISTICS, *At Maximum Ratings and at Indicated Case Temperature (T_C) Unless Otherwise Indicated*

CHARACTERISTICS	SYMBOL	LIMITS			UNITS
		MIN.	TYP.	MAX.	
Peak Off-State Current:♠ Gate open, T_J = 100°C, V_{DROM} = Max. rated value	I_{DROM}	–	0.1	2*	mA
Maximum On-State Voltage:♠ For i_T = 14 A (peak), T_C = 25°C (2N5567, 68, 69, 70, T4101M, T4111M, T4121 series)	V_{TM}	–	1.35	1.65*	mA
= 21 A (peak), T_C = 25°C (2N5571, 72, 73, 74, T4100M, T4110M, T4120 series)		–	1.4	1.8*	
DC Holding Current:♠ Gate open, Initial principal current = 500 mA (DC), v_D = 12 V: 2N5567, 68, 69, 70, T4101M, T4111M, T4121 series: T_C = 25°C	I_{HO}	–	15	30	mA
T_C = −65°C		–	75	200*	
2N5571, 72, 73, 74, T4100M, T4110M, T4120 series: T_C = 25°C		–	20	75	
T_C = −65°C		–	75	300*	
For other case temperature		See Fig. 9 & 10			
Critical Rate-of-Rise of Commutation Voltage:♠ For v_D = V_{DROM}, $I_{T(RMS)}$ = 10 A, commutating di/dt = 5.4 A/ms, gate unenergized, T_C = 85°C 2N5567, 68, 69, 70, T4101M, T4111M, T4121 series	dv/dt	2*	5	–	V/μs
For v_D = V_{DROM}, $I_{T(RMS)}$ = 15 A, commutating di%dt = 8 A/ms, gate unenergized, T_C = 80°C (2N5571, 72, 73, 74, T4100M, T4110M – Press-fit & stud types)		2*	10	–	
= 75°C (T4120B, D, M – Isolated-stud)		2	10	–	
Critical Rate-of-Rise of Off-State Voltage:♠ For v_D = V_{DROM}, exponential voltage rise, gate open, T_C = 100°C: 2N5567, 2N5569, T4121, 2N5571, 2N5573, T4120B	dv/dt	30*	150	–	V/μs
2N5568, 2N5570, T4121D, 2N5572, 2N5574, T4120D		20*	100	–	
T4101M, T4111M, T4121M, T4100M, T4110M, T4120M		10	75	–	
DC Gate-Trigger Current:♠◆ For v_D = 12 V (DC), R_L = 30Ω, T_C = 25°C Mode V_{MT2} V_G I^+ positive positive All 10-A triacs	I_{GT}	–	10	25	mA
All 15-A triacs		–	20	50	
III^- negative negative All 10-A triacs		–	10	25	
All 15-A triacs		–	20	50	
I^- positive negative All 10-A triacs		–	20	40	
All 15-A triacs		–	35	80	
III^+ negative positive All 10-A triacs		–	20	40	
All 15-A triacs		–	35	80	
For v_D = 12 V (DC), R_L = 30Ω, T_C = −65°C Mode V_{MT2} V_G I^+ positive positive All 10-A triacs		–	45	100*	
All 15-A triacs		–	75	150*	
III^- negative negative All 10-A triacs		–	45	100*	
All 15-A triacs		–	75	150*	
I^- positive negative All 10-A triacs		–	80	150*	
All 15-A triacs		–	100	200*	
III^+ negative positive All 10-A triacs		–	80	150*	
All 15-A triacs		–	100	200*	
For other case temperatures		See Fig. 12, 13, 14, & 15			
DC Gate-Trigger Voltage:♠◆ For v_D = 12 V(DC), R_L = 30Ω T_C = 25°C	V_{GT}	–	1	2.5	V
T_C = −65°C		–	2	4*	
For other case temperatures		See Fig. 16 & 17			
For v_D = V_{DROM}, R_L = 125Ω, T_C = 100°C		0.2	–	–	
Gate-Controlled Turn-On Time: (Delay Time + Rise Time) For v_D = V_{DROM}, I_{GT} = 160 mA, t_r = 0.1 μs, i_T = 15 A (peak) All 10-A triacs, i_T = 25 A (peak) All 15-A triacs, T_C = 25°C	t_{gt}	–	1.6	2.5	μs
Thermal Resistance: Junction-to-Case: Steady-State	$\theta_{J\text{-}C}$	–	–	1*	°C/W
Transient		See Fig. 20			
Junction-to-Isolated Hex (Stud, see Dim. Outline): Steady-State	$\theta_{J\text{-}IH}$	–	–	1.1	

* In accordance with JEDEC registration data format (JS-14, RDF 2) filed for the JEDEC (2N-Series) types.

♠ For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.

◆ For either polarity of gate voltage (V_G) with reference to main terminal 1.

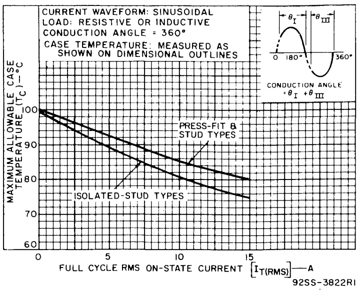


Fig. 4 – Maximum allowable case temperature vs. on-state current for all 15-A triacs.

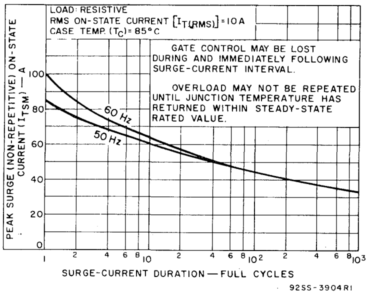


Fig. 5 – Peak surge on-state current vs. surge current duration for all 10-A triacs.

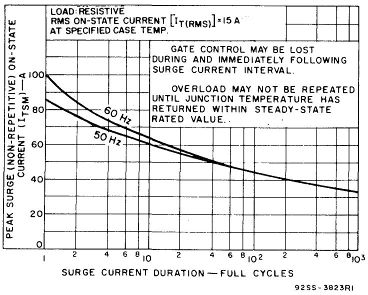


Fig. 6 – Peak surge on-state current vs. surge current duration for all 15-A triacs.

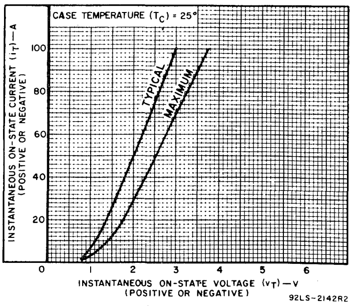


Fig. 7 – On-state current vs. on-state voltage for all 10-A triacs.

T4100 (2N5567-2N5570 , T4100M);
T4101 (2N5571-2N5574 , T4101M) Series

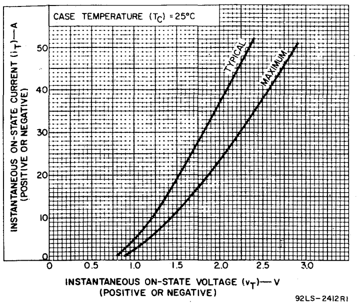


Fig. 8 — On-state current vs. on-state voltage for all 15-A triacs.

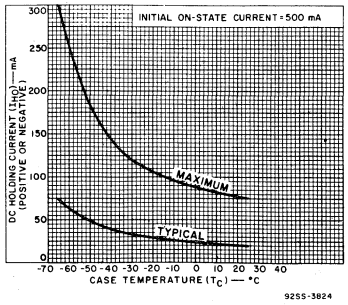


Fig. 9 — DC holding current vs. case temperature for all 10-A triacs.

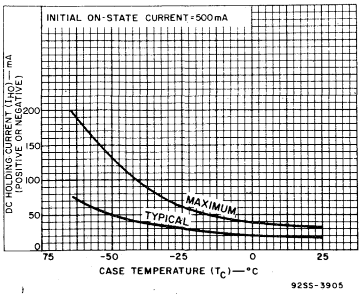


Fig. 10 — DC holding current vs. case temperature for all 15-A triacs.

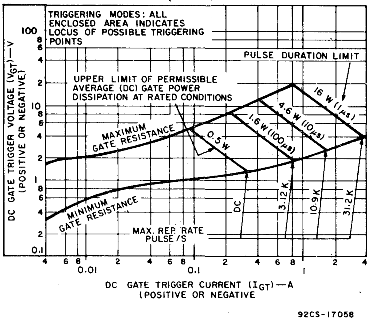


Fig. 11 — Gate trigger characteristics and limiting conditions for determination of permissible gate trigger pulses for all triacs.

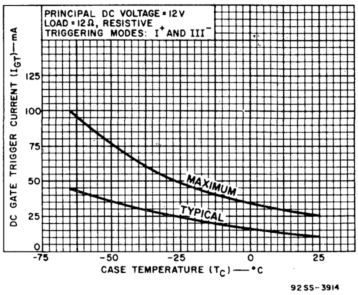


Fig. 12 — DC gate-trigger current vs. case temperature (I^+& III^- modes) for all 10-A triacs.

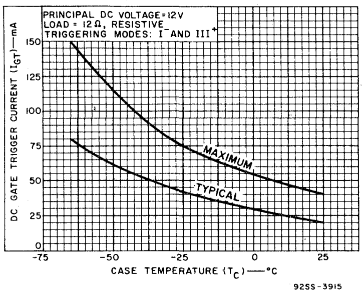


Fig. 13 — DC gate-trigger current vs. case temperature (I^- & III^+ modes) for all 10-A triacs.

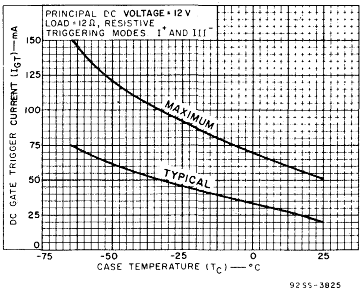


Fig. 14 — DC gate-trigger current vs. case temperature (I^+ & III^- modes) for all 15-A triacs.

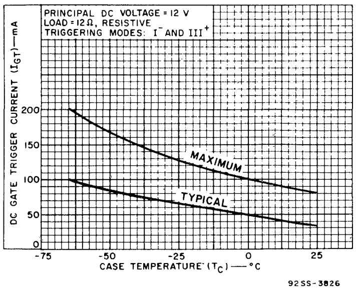


Fig. 15 — DC gate-trigger current vs. case temperature (I^- & III^+modes) for all 15-A triacs.

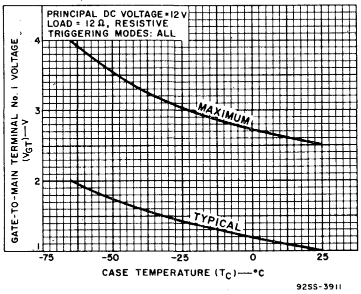


Fig. 16 — DC gate-trigger voltage vs. case temperature for all 10-A triacs.

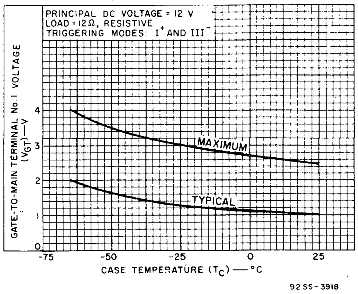


Fig. 17 — DC gate-trigger voltage vs. case temperature for all 15-A triacs.

T4100 (2N5567-2N5570, T4100M);
T4101 (2N5571-2N5574, T4101M) Series

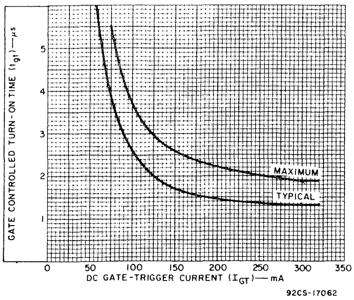


Fig. 18 – Turn-on time vs. gate trigger current for all types.

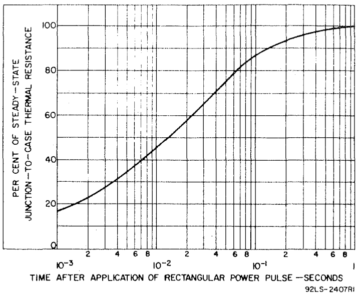


Fig. 19 – Transient junction-to-case thermal resistance vs. time for all triacs.

WARNING:
The RCA isolated-stud package thyristors should be handled with care. The ceramic portion of these thyristors contains BERYLLIUM OXIDE as a major ingredient. Do not crush, grind, or abrade these portions of the thyristors because the dust resulting from such action may be hazardous if inhaled.

T4103-T4105, T4113-T4115 Series

400-Hz, 6,10, & 15-A Silicon Triacs

For Control-Systems Application in Airborne and Ground-Support Type Equipment

These RCA triacs are gate-controlled full-wave silicon ac switches.

The devices are designed to switch from an off-state to an on-state for either polarity of applied voltage with positive or negative gate triggering voltages.

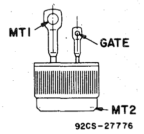
They are intended for operation up to 400 Hz with resistive or inductive loads and nominal line voltages of 115 and 208 V RMS sine wave and repetitive peak off-state voltages of 200 V and 400 V.

These triacs exhibit commutating voltage (dv/dt) capability at high commutating current (di/dt). They can also be used in 60-Hz applications where high commutating capability is required.

Features:

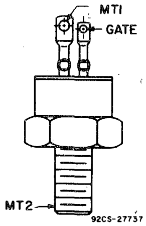
- **di/dt capability = 150 A/µs**
- **Shorted-emitter center-gate design**
- **Commutating dv/dt capability characterized at 400 Hz**

TERMINAL CONNECTIONS



T4103 Series
T4104 Series
T4105 Series

Press-fit



T4113 Series
T4114 Series
T4115 Series

Stud

MAXIMUM RATINGS, *Absolute-Maximum Values:*
For Operation with Sinusoidal Supply Voltage at Frequencies up to 400 Hz and with Resistive or Inductive Load.

		T4103B T4113B T4104B T4114B T4105B T4115B	T4103D T4113D T4104D T4114D T4105D T4115D	
REPETITIVE PEAK OFF-STATE VOLTAGE:*	V_{DROM}			
Gate open, T_J = −50 to 100°C		200	400	V
RMS ON-STATE CURRENT (Conduction angle = 360°):	$I_{T(RMS)}$			
Case temperature				
T_C = 90°C (T4105B, T4105D, T4115B, T4115D)		6		A
= 85°C (T4104B, T4104D, T4114B, T4114D)		10		A
= 80°C (T4103B, T4103D, T4113B, T4113D)		15		A
For other conditions		*See Fig.* 2		
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:	I_{TSM}			
For one cycle of applied principal voltage, T_C as above				
400 Hz (sinusoidal)		200		A
60 Hz (sinusoidal)		100		A
50 Hz (sinusoidal)		85		A
For more than one cycle of applied principal voltage		See Fig. 3		
RATE-OF-CHANGE OF ON-STATE CURRENT:	di/dt			
V_{DM} = V_{DROM}, I_{GT} = 160 mA, t_r = 0.1 µs		150		A/µs
FUSING CURRENT (for triac protection):				
T_J = −50 to 100°C, t = 1.25 to 10 ms	I^2t	30		A^2s
PEAK GATE-TRIGGER CURRENT:■	I_{GTM}			
For 1 µs max., *(See Fig. 7)*		4		A
GATE POWER DISSIPATION:				
PEAK (For 1 µs max., I_{GTM} ≤4 A. See Fig. 6)	P_{GM}	16		W
AVERAGE	$P_{G(AV)}$	0.2		W
TEMPERATURE RANGE:▲				
Storage	T_{stg}	-50 to 150		°C
Operating (Case)	T_C	-50 to 100		°C
TERMINAL TEMPERATURE (During soldering):				
For 10 s max. (terminals and case)	T_T	225		°C
STUD TORQUE: τ_s				
Recommended		35		in-1b
Maximum (DO NOT EXCEED)		50		in-1b

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* For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.
■ For either polarity of gate voltage (V_G) with reference to main terminal 1.
▲ For temperature measurement reference point, see Dimensional Outline.

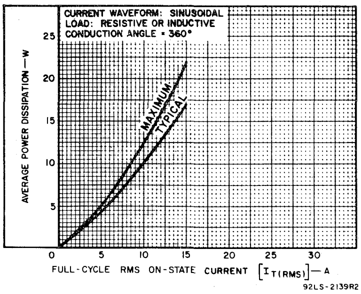


Fig. 1—Power dissipation vs. on-state current.

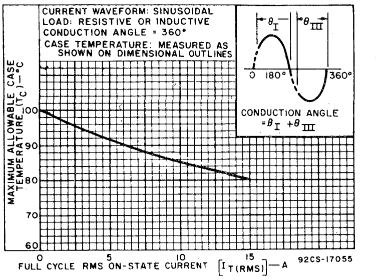


Fig. 2—Maximum allowable case temperature vs. on-state current.

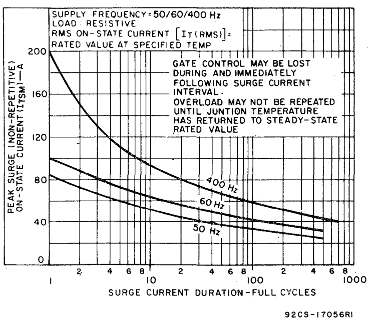


Fig. 3—Peak surge on-state current vs. surge-current duration.

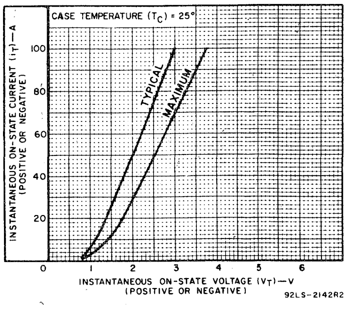


Fig. 4—On-state current vs. on-state voltage.

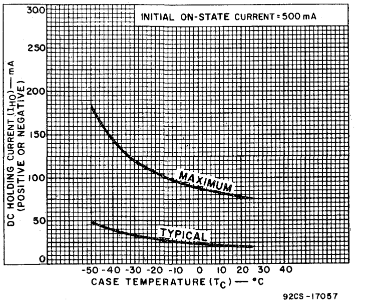


Fig. 5—DC holding current vs. case temperature.

T4103-T4105, T4113-T4115 Series

ELECTRICAL CHARACTERISTICS

At Maximum Ratings and at Indicated Case Temperature (T_C) Unless Otherwise Specified

CHARACTERISTIC	SYMBOL	LIMITS ALL TYPES Min.	 Typ.	 Max.	UNITS
Peak Off-State Current:♠ Gate open, T_J = 100°C , V_{DROM} = Max. rated value	I_{DROM}	-	0.1	2	mA
Maximum On-State Voltage:♠ For i_T = 21 A (peak), T_C = 25 °C.	V_{TM}	-	1.4	1.8	V
DC Holding Current:♠ Gate open, Initial principal current = 500 mA (DC), v_D = 12 V, T_C = 25° C.	I_{HO}	-	20	75	mA
For other case temperatures			See Fig. 5		
Critical Rate-of-Rise of Commutation Voltage:♠ For v_D = V_{DROM}, $I_{T(RMS)}$ = rated value, gate unenergized Commutating di/dt = 21.4 A/ms, T_C = 90° C T4105B, T4105D, T4115B, T4115D	dv/dt	5	10	-	V/μs
Commutating di/dt = 36 A/ms, T_C = 85° C T4104B, T4104D, T4114B, T4114D		5	10	-	
Commutating di/dt = 53.3 A/ms, T_C = 80° C T4103B, T4103D, T4113B, T4113D		5	10	-	
Critical Rate-of-Rise of Off-State Voltage:♠ For v_D = V_{DROM}, exponential voltage rise, gate open, T_C = 100° C.	dv/dt	30	150	-	V/μs
DC Gate-Trigger Current:♠† Mode / V_{MT2} / V_G For v_D = 12 V (DC), R_L = 30 Ω, and T_C = 25 °C I+ / positive / positive	I_{GT}	-	20	50	mA
III− / negative / negative		-	20	50	
I− / positive / negative		-	35	80	
III+ / negative / positive		-	35	80	
For other case temperatures.			See Figs. 7 & 8		
DC Gate-Trigger Voltage:♠† For v_D = 12 V(DC), R_L = 30Ω, T_C = 25°C.	V_{GT}	–	1	2.5	V
For other case temperatures.			See Fig. 9		
For v_D = V_{DROM}, R_L = 125Ω, T_C = 100°C		0.2	–	–	
Gate-Controlled Turn-On Time: (Delay Time + Rise Time) For v_D = V_{DROM}, I_{GT} = 160mA, t_r = 0.1 μs, i_T = 25A (peak), T_C = 25°C	t_{gt}	–	1.6	2.5	μs
Thermal Resistance Steady-State (Junction-to-Case)	$\theta_{J\text{-}C}$	–	–	1	°C/W
Transient (Junction-to-Case).			See Fig. 11		
Steady-State (Junction-to-Ambient).	$\theta_{J\text{-}A}$	–	–	33	°C/W

♠ For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.

† For either polarity of gate voltage (V_G) with reference to main terminal 1.

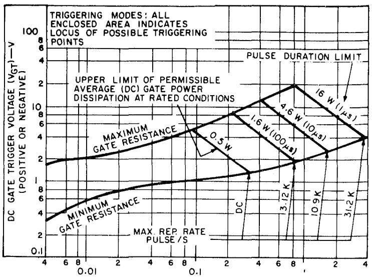


Fig. 6—Gate-trigger characteristics and limiting conditions for determination of permissible gate-trigger pulses.

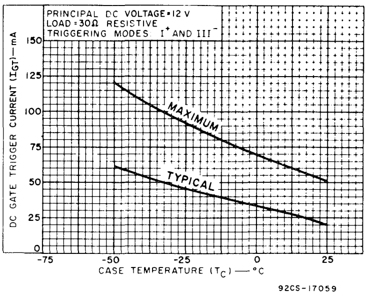


Fig. 7—DC gate-trigger current vs. case temperature. (I^+ and III^- modes).

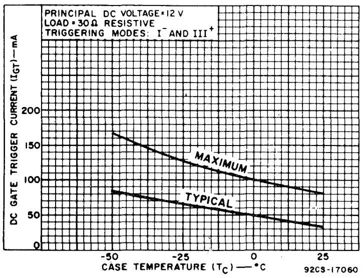


Fig. 8—DC gate-trigger current vs. case temperature. (I^- and III^+ modes).

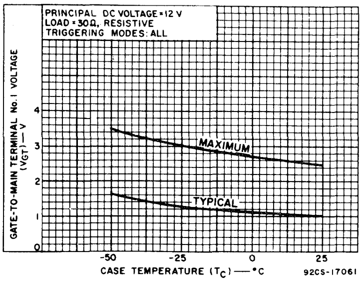


Fig. 9—DC gate-trigger voltage vs. case temperature.

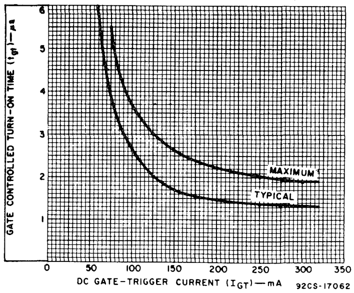


Fig. 10—Turn-on time vs. gate-trigger current.

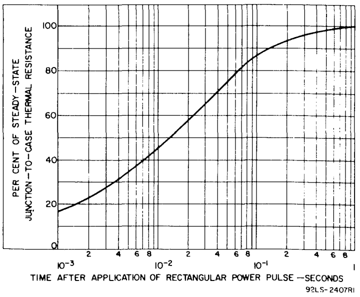


Fig. 11—Transient thermal resistance vs. time (junction-to-case).

T4130, T4131, T4140, T4141, T4150, T4151, T6430, T6431, T6440, T6441, T6450, T6451 Series

10-, 15-, 30-, and 40-A Silicon Triacs

For Phase-Control and Load-Switching Applications

These RCA triacs are gate-controlled, full wave ac switches. They are designed to switch from an off-state to an on state for either polarity of applied voltage with positive or negative gate triggering voltages.

The T4130, T4140, and T4150 series have current ratings of 15 amperes. The T4131, T4141, and T4151 series have current ratings of 10 amperes. The T6430, T6440, and T6450 series have current ratings of 40 amperes. The T6431, T6441, and T6451 series have current ratings of 30 amperes. Triacs in each series have voltage ratings of 200, 400, and 600 volts. In addition, the 40-A T6430, T6440, and T6450 series also include 800-volt types.

The T4130, T4131, T6430, and T6431 series employ a press-fit package with flexible leads, encapsulated on an isolated stud.

10-A Triacs – T4131, T4141, and T4151 Series **Electrical and Mechanical Data**

Type No.	Rep. Peak Off-State Voltage V_{DROM} (V)	On-State Current I_T (RMS) (A)	On-State Current T_C (°C)	Package (Press-fit)	Wire Size MT 1&2 Gage No.	Wire Size Gate Gage No.	Wire Insulation Thickness MT 1&2 in. (mm)	Wire Insulation Thickness Gate in. (mm)	Refer to Bulletin File No.*
T4131B T4131D T4131M	200 400 600	10	85	With flex.leads, encap.on isolated-stud	14	22	0.031 (0.787)	0.016 (0.406)	457
T4141B T4141D T4141M	200 400 600	10	85	Isolated on TO-3 flange	–	–	–	–	457
T4151B T4151D T4151M	200 400 600	10	85	With flex.leads, encap.,isolated on TO-3 flange	14	22	0.031 (0.787)	0.016 (0.406)	457

15-A Triacs – T4130, T4140, and T4150 Series **Electrical and Mechanical Data**

T4130B T4130D T4130M	200 400 600	15	75	With flex.leads, encap.on isolated-stud	14	22	0.031 (0.787)	0.016 (0.406)	458
T4140B T4140D T4140M	200 400 600	15	75	Isolated on TO-3 flange	–	–	–	–	458
T4150B T4150D T4150M	200 400 600	15	75	With flex.leads, encap.,isolated on TO-3 flange	14	22	0.031 (0.787)	0.016 (0.406)	458

30-A Triacs – T6431, T6441, and T6451 Series **Electrical and Mechanical Data**

T6431B T6431D T6431M	200 400 600	30	55	With flex.leads, encap.on isolated-stud	12	22	0.034 (0.863)	0.016 (0.406)	459
T6441B T6441D T6441M	200 400 600	30	55	Isolated on TO-3 flange	–	–	–	–	459
T6451B T6451D T6451M	200 400 600	30	55	With flex.leads, encap.,isolated on TO-3 flange	12	22	0.034 (0.863)	0.016 (0.406)	459

40-A Triacs – T6430, T6440, and T6450 Series **Electrical and Mechanical Data**

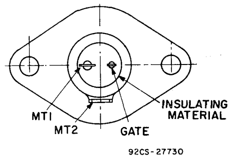
T6430B T6430D T6430M T6430N	200 400 600 800	40	60	With flex.leads, encap. on isolated-stud	12	22	0.034 (0.863)	0.016 (0.406)	593
T6440B T6440D T6440M T6440N	200 400 600 800	40	60	Isolated on TO-3 flange	–	–	–	–	593
T6450B T6450D T6450M T6450N	200 400 600 800	40	60	With flex.leads, encap.,isolated on TO-3 flange	12	22	0.034 (0.863)	0.016 (0.406)	593

* Electrical characteristics and ratings given in these bulletins also apply to the types listed in this chart.

Features:

- **3-kV rms encapsulant (HYPOT) breakdown voltage**
- **Flame-resistant encapsulant (self-extinguishing)**
- **Rugged packages**
- **Standard RCA triac features**

TERMINAL CONNECTIONS



Press-Fit, Isolated on TO-3 Flange

T4140	T6440
T4141	T6441

FLEXIBLE-LEAD (TERMINAL) CONNECTIONS

Flexible-Lead (Insulation) Color	Terminal
Yellow –	Gate
Red –	Main Terminal No. 1
Black –	Main Terminal No. 2

Note: Terminals are identified by color code only. Position of the flexible leads (relative to terminals of the device) leaving the encapsulant is random.

Press-Fit, Encapsulated on Isolated-Stud with Flexible Leads

T4130	T6430
T4131	T6431

Press-Fit, Encapsulated, Isolated on TO-3 Flange with Flexible Leads

T4150	T6450
T4151	T6451

WARNING: The ceramic used in these packages contains beryllium oxide. Do not crush, grind, or abrade these portions because the dust resulting from such action may be hazardous if inhaled. Disposal should be by burial.

The T4140, T4141, T6440, and T6441 series employ a press-fit package, isolated on a TO-3 flange. The T4150, T4151, T6450, and T6451 series employ a press-fit package with flexible leads encapsulated on an isolated TO-3 flange.

T4700 Series

15-Ampere Silicon Triacs

For Low-Power Phase-Control and Load-Switching Applications

Features:
- **di/dt Capability = 150 A/μs**
- **Shorted-Emitter, Center-Gate Design**
- **Low Switching Losses**
- **Low On-State Voltage at High Current Levels**
- **Low Thermal Resistance**

RCA T4700B and T4700D* are gate-controlled full-wave ac silicon switches. They are designed to switch from an off-state to a conducting state for either polarity of applied voltage with positive or negative gate triggering.

These devices are intended for the control of ac loads in applications such as space heater, oven and furnace controls, motor controls, and lamp loads.

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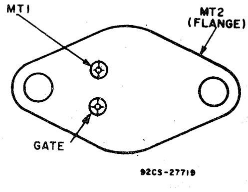
*Formerly Dev. Types TA2834 and TA2835, respectively.

TERMINAL CONNECTIONS



BOTTOM VIEW

JEDEC TO-66

MAXIMUM RATINGS, *Absolute-Maximum Values:*

For Operation with 50/60-Hz, Sinusoidal Supply Voltage and Resistive or Inductive Load

		T4700B	T4700D	
REPETITIVE PEAK OFF-STATE VOLTAGE:■				
Gate Open	V_{DROM}	200	400	V
RMS ON-STATE CURRENT:				
T_C = 70°C, conduction angle = 360°	$I_{T(RMS)}$	15	15	A
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:	I_{TSM}			
For one full cycle of applied principal voltage 60 Hz (sinusoidal); T_C = 70°C		100	100	A
For one full cycle of applied principal voltage (50-Hz, sinusoidal), T_C = 70°C		85	85	A
For more than one full cycle of applied voltage		See Fig. 3	See Fig. 3	
PEAK GATE-TRIGGER CURRENT:				
For 1 μs max.	I_{GTM}	4	4	A
RATE OF CHANGE OF ON-STATE CURRENT:				
$V_D = V_{DROM}$, I_{GT} = 200 mA, tr = 0.1 μs	di/dt	150	150	A/μs
FUSING CURRENT (for triac protection):				
T_J = −40 to 100°C, t = 1.25 to 10 ms	I^2t	50	50	A^2s
GATE POWER DISSIPATION:				
Peak● (for 1 μs max. and I_{GTM} = ≤ 4 A)	P_{GM}	16	16	W
Average (averaging time = 10 ms max.)	$P_{G(AV)}$	0.45	0.45	W
TEMPERATURE RANGE:▲				
Storage	T_{stg}	−40 to 150	−40 to 150	°C
Operating (Case)	T_C	−40 to 100	−40 to 100	°C
PIN TEMPERATURE (During soldering):				
At distances ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max.	T_P	225	225	°C

■ For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.

● For either polarity of gate voltage (V_G) with reference to main terminal 1.

▲ For temperature measurement reference point, *see Dimensional Outline.*

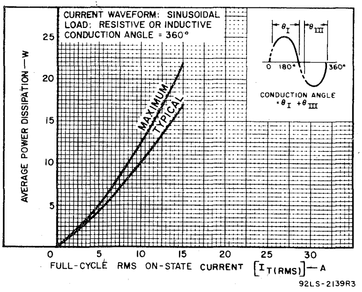


Fig. 1—Power dissipation curve.

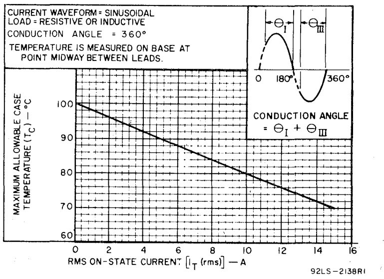


Fig. 2—Conduction rating chart (case temperature).

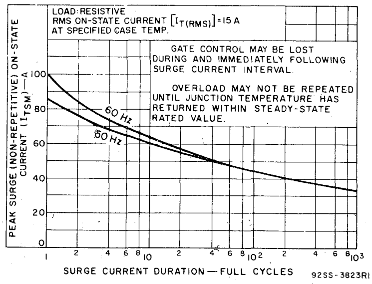


Fig. 3—Surge current rating chart.

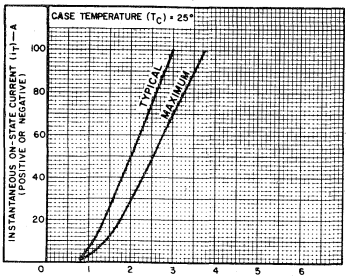


Fig. 4—On-state characteristics for either direction of principal current.

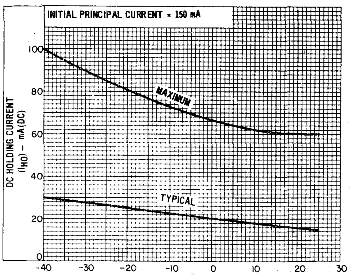


Fig. 5—DC holding current characteristics for either direction of principal current.

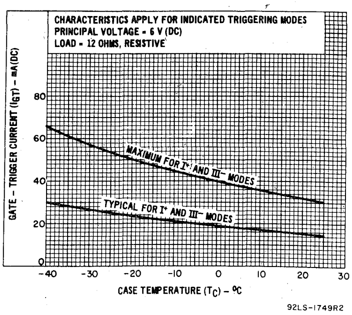


Fig. 6—DC gate-trigger current characteristics for I^+ and III^- modes.

T4700 Series

ELECTRICAL CHARACTERISTICS

At Maximum Ratings Unless Otherwise Specified and at Indicated Case Temperature (T_C)

CHARACTERISTICS	TRIAC TYPES						UNITS
	T4700B			T4700D			
	Min.	Typ.	Max.	Min.	Typ.	Max.	
Peak Off-State Current♣, I_{DROM}							
Gate open							
At T_j = +100° C and V_{DROM} = Max. rated value	–	0.2	4	–	0.2	4	mA
Instantaneous On-State Voltage♣, v_T							
For i_T = 30 A (peak) and T_C = +25° C.	–	1.6	2.0	–	1.6	2.0	V(peak)
DC Holding Current♣, I_{HO}:							
Gate Open							
Initial principal current = 150 mA (dc)							
At T_C = +25° C.	–	15	60	–	15	60	mA(dc)
For other case temperatures.		See Fig. 5			See Fig.5		
Critical Rate of Applied Commutating Voltage♣,							
Commutating dv/dt:							
For v_D = V_{DROM}, $I_{T(RMS)}$ = 15 A, commutating di/dt = 8 A/ms, and gate unenergized							
At T_C = +70° C.	2	10	–	2	10	–	V/µs
Critical Rate of Rise of Off-State Voltage♣,							
Critical dv/dt:							
For v_D = V_{DROM}, exponential voltage rise, gate open							
At T_C = +100° C.	30	150	–	20	100	–	V/µs
DC Gate-Trigger Current♣ ■, I_{GT}							
For v_D = 6 volts (dc), R_L = 12 ohms, T_C = +25° C, and Specified Triggering Mode:							
I^+ Mode: V_{T2} is positive, V_G is positive. . .	–	15	30	–	15	30	mA(dc)
I^- Mode: V_{T2} is positive, V_G is negative. . .	–	35	80	–	35	80	mA(dc)
III^+ Mode: V_{T2} is negative, V_G is positive. . .	–	35	80	–	35	80	mA(dc)
III^- Mode: V_{T2} is negative, V_G is negative. . .	–	15	30	–	15	30	mA(dc)
For other case temperatures.		See Figs. 6 & 7			See Figs. 6 & 7		
DC Gate-Trigger Voltage♣ ■, V_{GT}:							
For v_D = 6 volts (dc) and R_L = 12 ohms							
At T_C = +25° C.	–	1	2.5	–	1	2.5	V(dc)
For other case temperatures.		See Fig. 8			See Fig. 8		
For v_D = V_{DROM} and R_L = 125 ohms							
At T_C = +100° C.	0.2	–	–	0.2	–	–	V(dc)
Gate-Controlled Turn-On Time, t_{gt}							
(Delay Time + Rise Time)							
For v_D = V_{DROM}, I_{GT} = 160 mA, 0.1 µs rise time, and i_T = 25 A (peak)							
At T_C = +25° C.	–	1.6	2.5	–	1.6	2.5	µs
Thermal Resistance, Junction to case,							
$R_{\theta JC}$	–	–	1.3	–	–	1.3	°C/W

♣For either polarity of main terminal 2 voltage (V_{T2}) with reference to main terminal 1.

■For either polarity of gate voltage (V_G) with reference to main terminal 1.

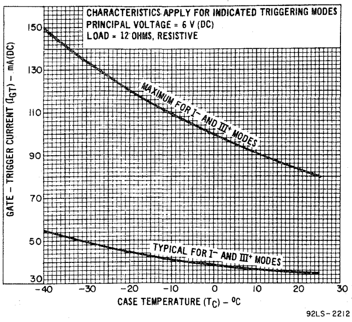


Fig. 7—DC gate-trigger current characteristics for I^- and III^+ modes.

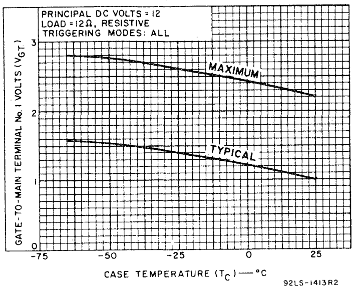


Fig. 8—DC gate-trigger voltage characteristics.

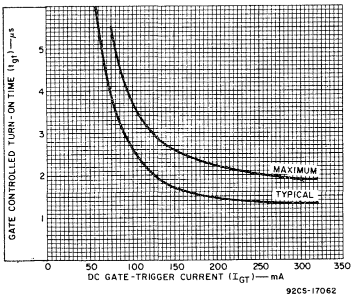


Fig. 9—Turn-on time vs. gate-trigger current.

T6000, T6001, T6006 Series
16-A Silicon Triacs

Three-Lead Plastic Types for Power-Control and Power-Switching Applications

The RCA-T6000, T6001 and T6006 series triacs are gate-controlled full-wave silicon switches utilizing a plastic case with three leads to facilitate mounting on printed-circuit boards. They are intended for the control of ac loads in such applications as motor controls, light dimmers, heating controls, and power-switching systems.

These devices are designed to switch from an off-state to an on-state for either polarity of applied voltage with positive or negative gate triggering voltages. They have an on-state current rating of 16 amperes at a T_C of 80°C and repetitive off-state voltage ratings of 200, 300, 400, 500, and 600 volts.

The T6001-series triacs are characterized for I^+, III^- gate triggering modes only and should suit a wide range of applications that employ diac or anode on/off triggering.

The T6006-series triacs are characterized for I^+ and III^+ gate-triggering modes only. They are intended for power-control applications in which integrated-circuit zero-crossing switches, such as the RCA-CA3059 series, are used as the triac-triggering circuits. The T6006-series triacs have gate characteristics which assure that a CA3059-series integrated circuit can supply sufficient gate current to trigger them over their full operating temperature range.

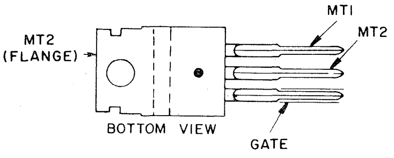
The plastic package design provides not only ease of mounting but also low thermal impedance, which allows operation at high case temperatures and permits reduced heat-sink size.

Lead-form options of the TO-220 package are available. See page on "Lead-Form for RCA Plastic Power Packages".

Features:

- **150-A peak surge full-cycle current ratings**
- **Shorted-emitter center-gate design**
- **Low switching losses**
- **Low thermal resistance**
- **Package design facilitates mounting on a printed-circuit board**

TERMINAL DESIGNATIONS



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JEDEC TO-220AB

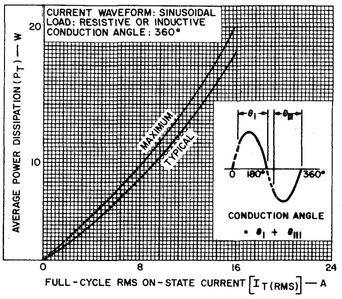

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Fig. 1 — Power dissipation vs on-state current.

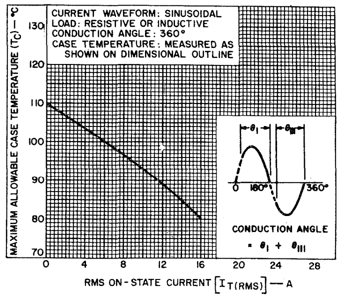

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Fig. 2 — Maximum allowable case-temperature vs on-state current.

Maximum Ratings, *Absolute-Maximum Values:*

	T6000B T6001B T6006B	T6000C T6001C T6006C	T6000D T6001D T6006D	T6000E T6001E T6006E	T6000M T6001M T6006M	
V_{DROM}● T_J = −65 to 110°C	200	300	400	500	600	V
$I_{T(RMS)}$ T_C = 80°C, θ = 360°)			16			A
For other conditions			See Fig. 2			
I_{TSM}						
For one cycle of applied principal voltage						
60 Hz (sinusoidal), T_C = 80°C.			150			A
50 Hz (sinusoidal), T_C = 80°C.			140			A
For more than one cycle of applied principal voltage			See Fig. 3			
di/dt						
$v_D = V_{DROM}$, I_{GT} = 200 mA, t_r = 0.1 μs			100			A/μs
I^2t [At T_C shown for $I_{T(RMS)}$]:						
t = 10 ms			100			A^2s
= 4.25 ms			49			A^2s
I_{GTM}■						
For 1 μs max.			4			A
P_{GM} (For 1 μs max., $I_{GTM} \leqslant 4$ A)			16			W
$P_{G(AV)}$			0.5			W
T_{stg}			−65 to 150			°C
T_C			−65 to 110			°C
T_T (During soldering for 10 s max.)			225			°C

● For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.

■ For either polarity of gate voltage (V_G) with reference to main terminal 1.

T6000, T6001, T6006 Series

ELECTRICAL CHARACTERISTICS

At Maximum Ratings Unless Otherwise Specified, and at Indicated Temperatures

CHARACTERISTIC	LIMITS For All Types Except as Specified			UNITS
	Min.	Typ.	Max.	
I_{DROM}●				
T_J = 110°C, V_{DROM} = Max. rated value	–	0.1	1.2	mA
v_{TM}● T6000, T6006 Series	–	1.4	1.75	V
i_T = 30 A (peak), T_C = 25°C T6001 Series	–	1.8	2.0	
I_{HO}●				
v_D = 12 V, T_C = 25°C T6000 Series	–	15	35	mA
T6001 Series	–	20	50	
For other case temperatures		See Fig. 7		
dv/dt●▲				
v_D = V_{DROM}, $I_{T(RMS)}$ = 16 A, di/dt = 8.5A/ms, T_C = 80°C	4	10	–	V/μs
dv/dt●				
v_D = V_{DROM}, T_C = 100°C				
T6000B, T6001B, T6006B	100	300	–	V/μs
T6000C, T6001C, T6006C	85	275	–	
T6000D, T6001D, T6006D	75	250	–	
T6000E, T6001E, T6006E	65	225		
T6000M, T6001M, T6006M	60	200	–	
I_{GT}●■ Mode V_{MT2} V_G				
v_D = 12 V (dc) I⁺ positive positive T6000 series	–	25	50	mA
R_L = 30 Ω T6001 series	–	–	80	
T_C = 25°C T6006 series	–	–	45	
III⁻ negative negative T6000 series	–	25	50	
T6001 series	–	–	80	
I⁻ positive negative T6000 series only	–	45	80	mA
III⁺ negative positive T6000 series only	–	45	80	
T6006	–	–	45	
For other case temperatures		See Figs. 9 and 10		
V_{GT}●▲				
T6001 I⁺ III⁻	–	1.25	3.0	V
v_D = 12 V (dc), R_L = 30 Ω, T_C = 25°C . T6006 I⁺ III⁺	–	1.25	1.5	
T6000 all modes	–	1.25	2.5	
v_D = V_{DROM}, R_L = 125 Ω, T_C = 100°C	0.2	–	–	
For other case temperatures		See Fig. 11		
t_{gt}				
v_D = V_{DROM}, I_{GT} = 80 mA, t_r = 0.1 μs, i_T = 25 A (peak), T_C = 25°C	–	1.6	2.5	μs
$R_{\theta JC}$	–	–	1.5	°C/W
$R_{\theta JA}$	–	–	50	°C/W

● For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.

■ For either polarity of gate voltage (V_G) with reference to main terminal 1.

▲ Variants of these devices having dv/dt characteristics selected specifically for inductive loads are available on special order; for additional information, contact your RCA Representative or your RCA Distributor.

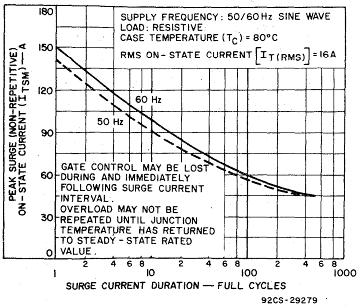


Fig. 3 – Peak surge on-state current vs surge current duration.

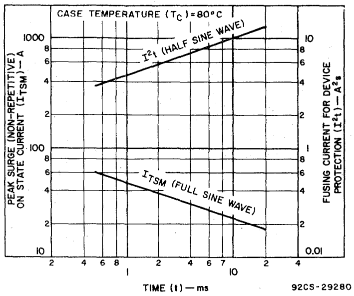


Fig. 4 – Peak surge on-state current and fusing-current vs time.

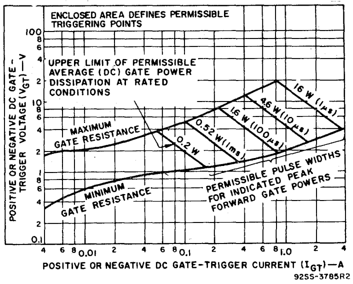


Fig. 5 – Gate pulse characteristics for all triggering modes.

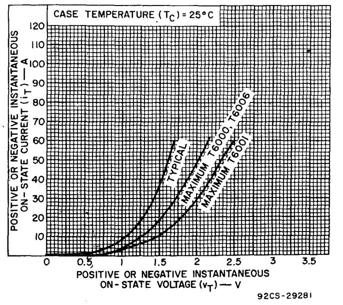
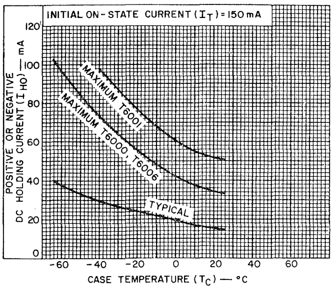


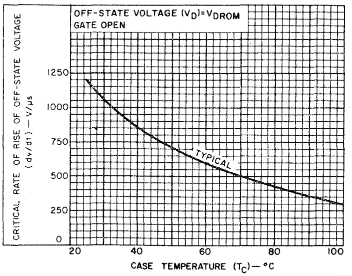
Fig. 6 – On-state current vs on-state voltage.

T6000, T6001, T6006 Series



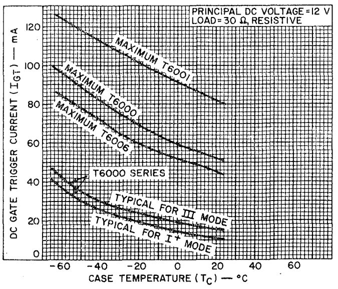
92CS-29282

Fig. 7 — DC holding current vs case temperature.



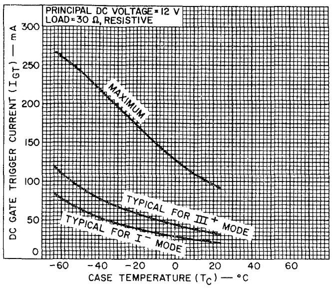
92SS-3907R1

Fig. 8 — Typical critical rate-of-rise of off-state voltage vs case temperature.



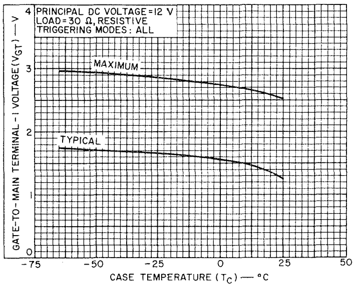
92CS-29283

Fig. 9 — DC gate-trigger current (for I^+ and III^- triggering modes) vs case temperature.



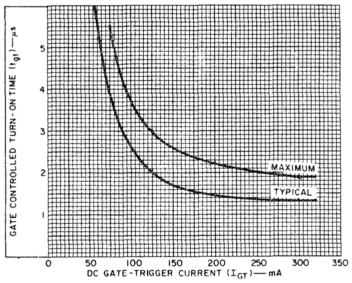
92CS-29284

Fig. 10 — DC gate-trigger current (for I^- and III^+ triggering modes) vs case temperature for T6000-series only.



92CS-29285

Fig. 11 — DC gate-trigger voltage vs case temperature for T6000 series only.



92CS-17062

Fig. 12 — Turn-on time vs gate-trigger current.

T6400, T6401, T6410, T6411, T6415, T6420, T6421 Series (Includes 2N5441-2N5446, 2N5806-2N5809)

25-A, 30-A, and 40-A Silicon Triacs

For General Purpose AC Power Switching Application
All 30-A and 40-A Triacs

For Control-Systems Application in Airborne and Ground Support Type Equipment
25-A, 400-Hz Triacs (2N5806-2N5809)

Features:

- di/dt Capability = 100 A/μs
- Shorted-Emitter, Center-Gate Design
- Low Switching Losses
- Low On-State Voltage at High Current Levels
- Low Thermal Resistance

Additional Features for the 2N5806-2N5809:

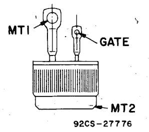
- Available in JAN or JANTX Screening
- Commutating dv/dt capability Characterized at 400 Hz

These RCA triacs are gate-controlled full-wave silicon ac switches. They are designed to switch from an off-state to an on-state for either polarity of applied voltage with positive or negative gate triggering voltages.

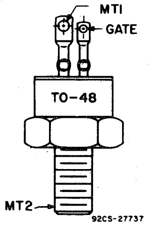
These triacs are intended for control of ac loads in applications such as heating controls, motor controls, arc-welding equipment, light dimmers, and power switching systems. They can also be used in air-conditioning and photocopying equipment.

Types 2N5441-43 T6400N, and T6401 series employ a press-fit package. Types 2N5444-46, 2N5806-09, T6410N, and T6411 series employ a stud package. T6420 series and T6421 series employ an isolated-stud package.

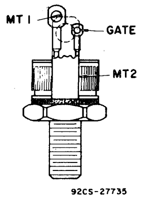
TERMINAL CONNECTIONS



Press-Fit Types



Stud Types



Isolated-Stud Types

MAXIMUM RATINGS, *Absolute-Maximum Values:*
For Operation with Sinusoidal Supply Voltage at Frequencies up to 50/400 Hz and with Resistive or Inductive Load.

	40-A	2N5441 2N5444 T6420B	2N5442 2N5445 T6420D	– – –	2N5443 2N5446 T6420M	T6400N T6410N T6420N	
	30-A	T6401B T6411B T6421B	T6401D T6411D T6421D	– – –	T6401M T6411M T6421M	– – –	
	25-A-	2N5806	2N5807	2N5808	2N5809	–	
*REPETITIVE PEAK OFF-STATE VOLTAGE:●	V_{DROM}						
Gate open, T_J = –65 to 110°C		200	400	500	600	800	V
RMS ON-STATE CURRENT (Conduction angle = 360°):	$I_{T(RMS)}$						
Case temperature							
* T_C = 70°C (2N5441;43, T6400N—Press-fit types)		40					A
= 65°C (2N5444-46, T6410N—Stud types)		40					A
= 60°C (T6420 series – Isolated-stud types)		40					A
= 65°C (T6401 series – Press-fit types)		30					A
= 60°C (T6411 series – Stud types)		30					A
= 55°C (T6421 series – Isolated-stud types)		30					A
= 80°C (2N5806-2N5809 – Stud types)		25					A
For other conditions		See Figs. 4, 5, 6					
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:	I_{TSM}						
For one cycle of applied principal voltage, T_C as above							
* 60 Hz (sinusoidal - 30-A & 40-A types)		300					A
50 Hz (sinusoidal - 30-A & 40-A types)		265					A
400 Hz (sinusoidal - 25-A types)		370					A
* 60 Hz (sinusoidal - 25-A types)		200					A
50 Hz (sinusoidal - 25-A types)		170					A
For more than once cycle of applied principal voltage		See Figs. 7, 8, 9					
RATE OF CHANGE OF ON-STATE CURRENT:	di/dt						
$V_{DM} = V_{DROM}$, I_{GT} = 200 mA, t_r = 0.1 μs		100					A/μs
FUSING CURRENT (For Triac Protection):	I^2t						
[At T_C shown for $I_{T(RMS)}$]:							
t = 20 ms (30-A & 40-A types)		500					A^2s
= 2.5 ms (30-A & 40-A types)		250					A^2s
= 0.5 ms (30-A & 40-A types)		145					A^2s
= 20 ms (25-A types)		240					A^2s
= 2.5 ms (25-A types)		110					A^2s
=0.5 ms (25-A types)		65					A^2s
*PEAK GATE-TRIGGER CURRENT:■	I_{GTM}						
For 1 μs max., See Fig. 15 (30-A and 40-A types only)		12					A
*GATE POWER DISSIPATION:							
PEAK (For 10 μs max., $I_{GTM} \leqslant 4$ A, –30-A & 40-A types)	P_{GM}	40					W
– 25-A types)	P_{GM}	10					W
AVERAGE (30-A & 40-A types)	$P_{G(AV)}$	0.75					W
(25-A types, t = 16.6 ms)	$P_{G(AV)}$	0.5					W
*TEMPERATURE RANGE:▲							
Storage (30-A & 40-A types)	T_{stg}	–65 to 150					°C
(25-A types)	T_{stg}	–55 to 125					°C
Operating (Case) – 40-A types	T_C	–65 to 110					°C
– 30-A types	T_C	–65 to 100					°C
– 25-A types	T_C	–40 to 115					°C
*TERMINAL TEMPERATURE:	T_T						
During soldering for 10 s max. (terminals and case)							
30-A & 40-A types		225					°C
25-A types		260					°C
STUD TORQUE:	τ_s						
Recommended		35					in-lb
		0.4					kgf-m
Maximum (DO NOT EXCEED)		50					in-lb
		0.57					kgf-m

WARNING: The ceramic of the isolated stud package contains beryllium oxide. Do not crush, grind, or abrade this part because the dust resulting from such action may be hazardous if inhaled. Disposal should be by burial.

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* In accordance with JEDEC registration data format (JS-14, RDF 2) filed for the JEDEC (2N-Series) types.

● For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.

■ For either polarity of gate voltage (V_G) with reference to main terminal 1.

▲ For temperature measurement reference point, see Dimensional Outline.

T6400, T6401, T6410, T6411, T6415, T6420, T6421 Series
(Includes 2N5441-2N5446,2N5806-2N5809)

ELECTRICAL CHARACTERISTICS, *At Maximum Ratings Otherwise Specified and at Indicated Case Temperature (T_C)*

CHARACTERISTICS	SYMBOL	LIMITS			UNITS
		MIN.	TYP.	MAX.	
Peak Off-State Current:♠					
Gate open, V_{DROM} = Max. rated value					
T_J = 110°C, (40-A types)	I_{DROM}	–	0.2	4*	mA
= 100°C, (30-A types)		–	0.2	4	
= 115°C, (25-A types)		–	0.2	2*	
Maximum On-State Voltage:♠					
For i_T = 100 A (peak), T_C = 25°C, (40-A types)	V_{TM}	–	1.7	2	V
For i_T = 56 A (peak), T_C = 25°C, (40-A types)		–	1.5	1.85*	
For i_T = 100 A (peak), T_C = 25°C, (30-A types)		–	2.1	2.5	
= 35 A (peak), pulse width ≤ 1 ms, duty cycle ≤ 2%, I_G = 150 mA, T_C = 25°C (25-A types)		–	1.3	1.6*	
DC Holding Current:♠					
Gate open, Initial principal current = 500 mA (dc), v_D = 12V:					
T_C = 25°C (30-A & 40-A types)	I_{HO}	–	25	60	mA
= 25°C (25-A types)		–	30	75	
= −65°C (40-A types)		–	–	100*	
= −40°C (25-A types)		–	45	100*	
For other case temperatures		See Figs. 13 & 14			
Critical Rate of Rise of Commutation Voltage:♠					
v_D = V_{DROM}, $I_{T(RMS)}$ = 40 A, commutating di/dt = 22 A/ms, gate unenergized,	dv/dt				V/μs
T_C= 70°C (40-A, Press-fit types)		5*	30	–	
= 65°C (40-A, Stud-types)		5*	30	–	
= 60°C (40-A, Isolated-stud types)		5*	30	–	
v_D = V_{DROM}, $I_{T(RMS)}$ = 30 A, commutating di/dt = 16 A/ms, gate unenergized,					
T_C= 65°C (30-A, Press-fit types)		3	20	–	
= 60°C (30-A, Stud types)		3	20	–	
= 55°C, (30-A, Isolated-stud types)		3	20	–	
v_D = V_{DROM}, $I_{T(RMS)}$ = 25 A, commutating di/dt = 88 A/ms, gate unenergized					
T_C = 80°C (25-A, Stud types)		5	–	–	
Critical Rate-of-Rise of Off-State Voltage:♠					
For v_D = V_{DROM}, exponential voltage rise, gate open	dv/dt				V/μs
T_C = 110°C (40-A types):					
2N5441, 2N5444, T6420B		50*	200	–	
2N5442, 2N5445, T6420D		30*	150	–	
2N5443, 2N5446, T6420M		20*	100	–	
T6400N, T6410N, T6420N		10*	75	–	
T_C = 100°C (30-A types):					
T6401B, T6411B, T6421B		40	200	–	
T6401D, T6411D, T6421D		25	150	–	
T6401M, T6411M, T6421M		20	100	–	
T_C = 115°C (25-A types)		20	100	–	
DC Gate-Trigger Current:♠♦					
v_D = 12 V (dc) R_L = 30Ω T_C = 25°C	I_{GT}				mA
Mode V_{MT2} V_G					
I^+ positive positive (40-A & 30-A types)		–	15	50	
(25-A types)		–	20	80	
III^- negative negative (40-A & 30-A types)		–	20	50	
(25-A types)		–	50	80	
I^- positive negative (40-A & 30-A types)		–	30	80	
(25-A types)		–	80	80	
III^+ negative positive (40-A & 30-A types)		–	40	80	
(25-A types)		–	100	150	
v_D = 12 V (dc) R_L = 30Ω T_C = −65°C					
Mode V_{MT2} V_G					
I^+ positive positive 40-A types only		–	–	125*	
III^- negative negative 40-A types only		–	–	125*	
I^- positive negative 40-A types only		–	–	240*	
III^+ negative positive 40-A types only		–	–	240*	
v_D = 12 V (dc) R_L = 25Ω T_C = 40°C					
Mode V_{MT2} V_G					
I^+ positive positive 25-A types only		–	32	120	
III^- negative negative 25-A types only		–	98	120	
I^- positive negative 25-A types only		–	–	170	
III^+ negative positive 25-A types only		–	–	–	
DC Gate-Trigger Voltage:♠♦					
v_D = 12 V (dc), R_L = 30Ω,	V_{GT}				V
T_C = 25°C (30-A & 40-A types)		–	1.35	2.5	
= −65°C (40-A types only)		–	1.8	3.4*	
For other case temperatures		See Fig. 20			
v_D = V_{DROM}, R_L = 125Ω, T_C = 110°C (40-A types)		0.2	–	–	
= 100°C (30-A types)		0.2	–	–	

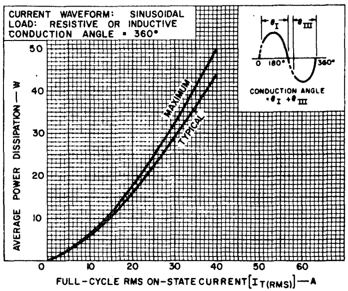


Fig. 1 — Power dissipation vs. on-state current for 2N5441-46, T6400N, T6410N, T6420 series.

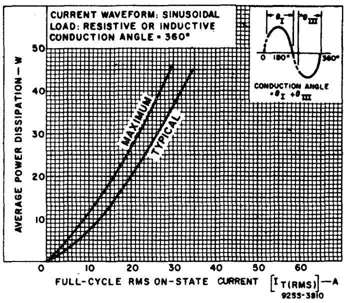


Fig. 2 — Power dissipation vs. on-state current for T6401, T6411, T6421 series.

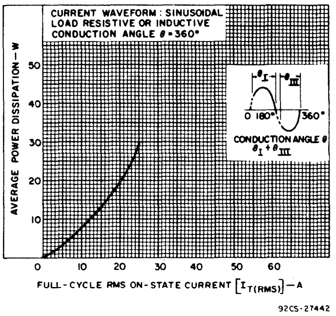


Fig. 3 — Power dissipation vs. on-state current for 2N5806-2N5809.

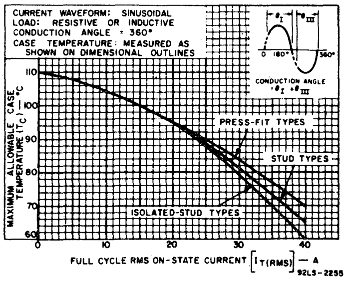


Fig. 4 — Maximum allowable case temperature vs. on-state current for 2N5441-46, T6400N, T6410N, T6420 series.

T6400, T6401, T6410, T6411, T6415, T6420, T6421 Series (Includes 2N5441-2N5446, 2N5806-2N5809)

ELECTRICAL CHARACTERISTICS, *At Maximum Ratings Otherwise Specified and at Indicated Case Temperature (T_C)*

CHARACTERISTICS	SYMBOL	LIMITS			UNITS
		MIN.	TYP.	MAX.	
DC Gate-Trigger Voltage: ♠♦	V_{GT}				V
v_D = 12 V (dc), R_L = 25 Ω					
Triggering Modes I^+, III^-, I^- (25-A types), T_C = 25°C		–	2	2.5	
= −40°C		–	2.6	4*	
Triggering Modes III^+ (25-A types), T_C = 25°C		–	3	4	
v_D = 12 V (dc), R_L = 1 kΩ,					
Triggering Modes I^+, III^-, I^- (25-A types): T_C = 115°C		0.15	–	–	
Gate-Controlled Turn-On Time:	t_{gt}				µs
(Delay Time + Rise Time)					
$v_D = V_{DROM}$, I_{GT} = 200 mA, t_r = 0.1 µs, i_T = 60 A (peak), T_C = 25°C (40-A types)		–	1.7	3	
$v_D = V_{DROM}$, I_{GT} = 200 mA, t_r = 0.1 µs, i_T = 45 A (peak), T_C = 25°C (30-A types)		–	1.7	3	
$v_D = V_{DROM}$, I_{GT} = 150 mA, t_r = 0.1 µs, i_T = 60 A (peak), T_C = 25°C (25-A types)		–	1.6	–	
Thermal Resistance, Junction-to-Case:	$R_{\theta JC}$				°C/W
Steady-State					
Press-fit types		–	–	0.8*	
Stud types		–	–	0.9*	
Stud types (25-A types only)		–	1	1.23*	
Isolated-stud types		–	–	1	
Transient (Press-fit & stud types)		See Fig. 24			
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$				
Steady-State (25-A types only)		–	–	50*	

* In accordance with JEDEC registration data format (JS-14, RDF 2) field for the JEDEC (2N-Series) types.

♠ For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.

♦ For either polarity of gate voltage (V_G) with reference to main terminal 1.

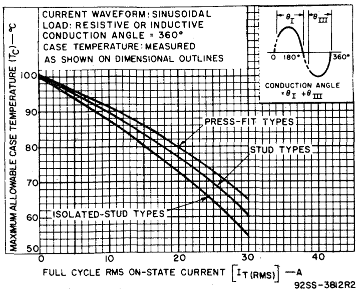


Fig. 5 — Maximum allowable case temperature vs. on-state current for T6401, T6411, T6421 series.

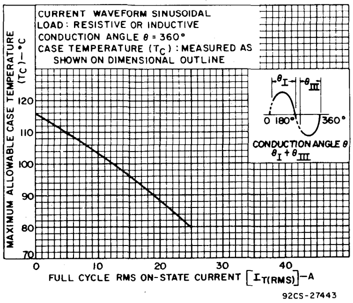


Fig. 6 — Maximum allowable case temperature vs. on-state current for 2N5806-2N5809.

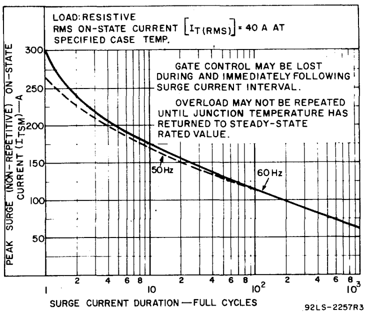


Fig. 7 — Peak surge on-state current vs. surge current duration for 2N5441-46, T6400N, T6410N, T6420 series.

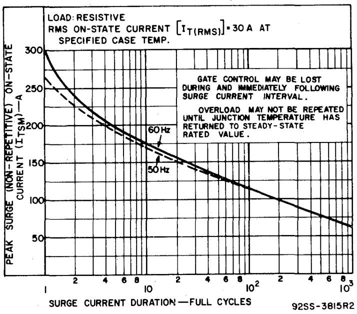


Fig. 8 — Peak surge on-state current vs. surge current duration for T6401, T6411, T6421 series.

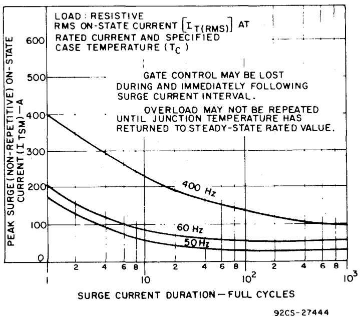


Fig. 9 — Peak surge on-state current vs. surge current duration for 2N5806-2N5809.

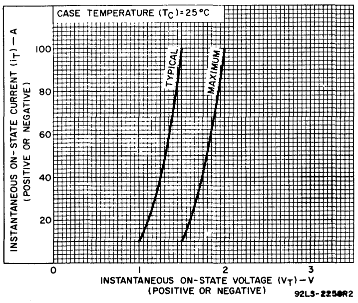


Fig. 10 — On-state current vs. on-state voltage for 2N5441-46, T6400N, T6410N, T6420 series.

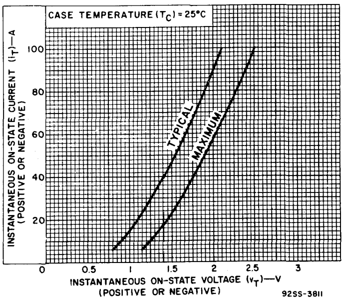


Fig. 11 — On-state current vs. on-state voltage for T6401, T6411, T6421 series.

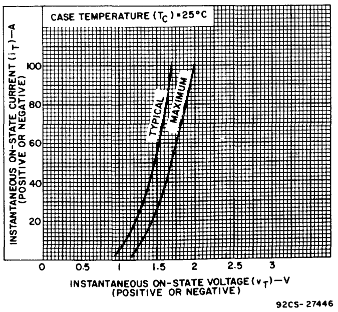


Fig. 12 — On-state current vs. on-state voltage for 2N5806-2N5809.

T6400, T6401, T6410, T6411, T6415, T6420, T6421 Series (Includes 2N5441-2N5446, 2N5806-2N5809)

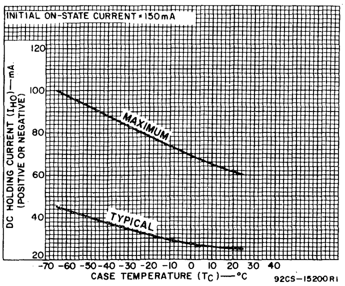


Fig. 13 – DC holding current vs. case temperature for 2N5441-46, T6400N, T6410N, T6420, T6401, T6411, T6421 series.

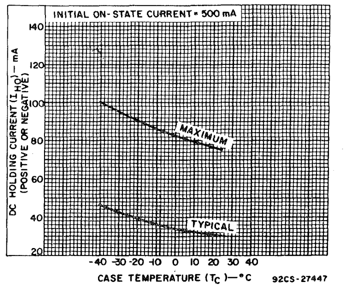


Fig. 14 – DC holding current vs. case temperature for 2N5806-2N5809 series.

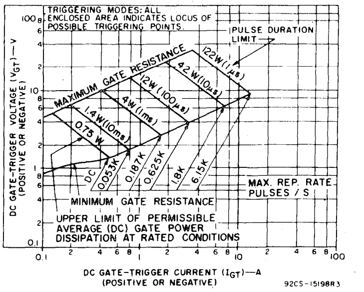


Fig. 15 – Gate-trigger characteristics and limiting conditions for determination of permissable gate-trigger pulses for 2N5441-46, T6400N, T6410N, T6420, T6401, T6411, T6421 series.

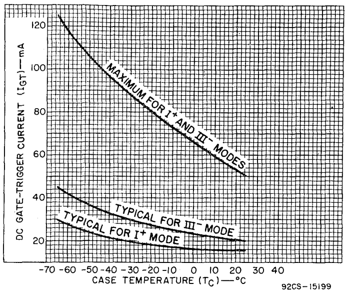


Fig. 16 – DC gate-trigger current vs. case temperature (1^+ & III^- modes) for 2N5441-46, T6400N, T6410N, T6420, T6401, T6411, T6421 series.

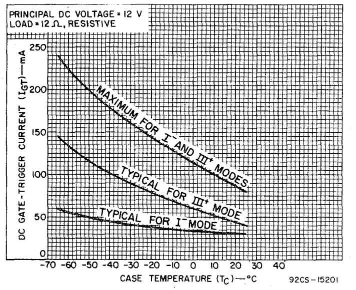


Fig. 17 – DC gate-trigger current vs. case temperature (I^- & III^+ modes) for 2N5441-46, T6400N, T6410N, T6420, T6401, T6411, T6421 series.

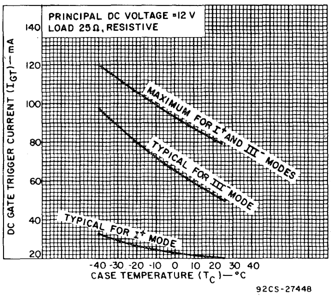


Fig. 18 – DC gate-trigger current vs. case temperature (1^+ & III^- modes) for 2N5806-2N5809.

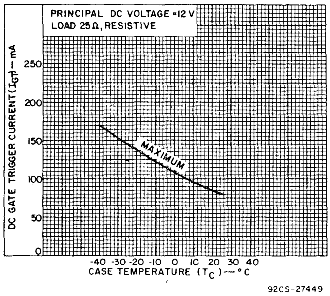


Fig. 19 – DC gate-trigger current vs. case temperature (1^- mode) for 2N5806-2N5809.

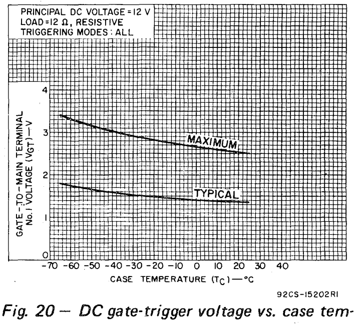


Fig. 20 – DC gate-trigger voltage vs. case temperature for 2N5441-46, T6400N, T6410N, T6420, T6401, T6411, T6421 series.

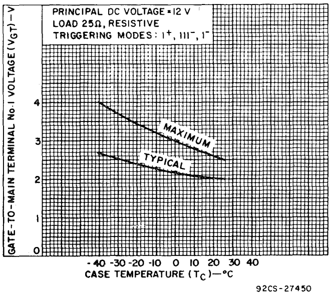


Fig. 21 – DC gate-trigger voltage vs. case temperature for 2N5806-2N5809.

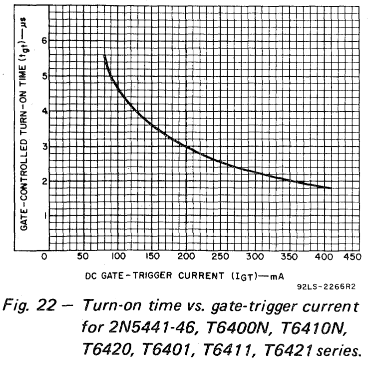


Fig. 22 – Turn-on time vs. gate-trigger current for 2N5441-46, T6400N, T6410N, T6420, T6401, T6411, T6421 series.

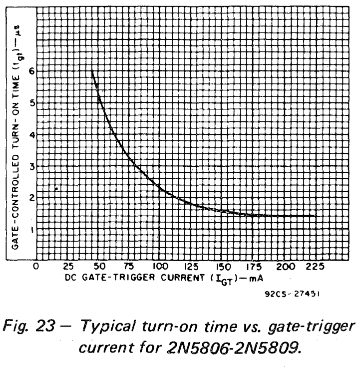


Fig. 23 – Typical turn-on time vs. gate-trigger current for 2N5806-2N5809.

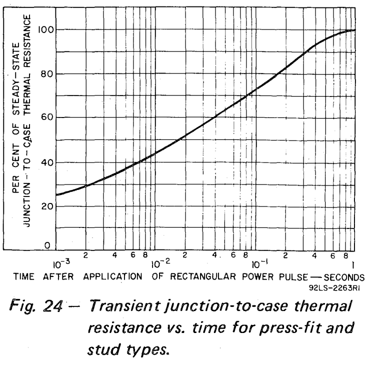


Fig. 24 – Transient junction-to-case thermal resistance vs. time for press-fit and stud types.

T6404, T6405, T6414, T6415 Series

400-Hz, 25 & 40-A Silicon Triacs

For Control-Systems Application in Airborne and Ground-Support Type Equipment

These RCA triacs are gate-controlled full-wave silicon ac switches. They are designed to switch from an off-state to an on-state for either polarity of applied voltage with positive or negative gate triggering voltages.

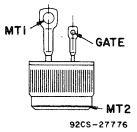
They are intended for operation at 400 Hz with resistive or inductive loads and nominal line voltages of 115 and 208 V RMS sine wave and repetitive peak off-state voltages of 200 V and 400 V.

These triacs exhibit commutating voltage (dv/dt) capability at high commutating current (di/dt). They can also be used in 60-Hz applications where high commutating capability is required.

Features:

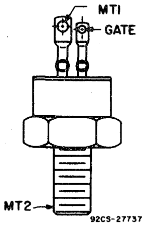
- **RMS On-State Current –**
  $I_{T(RMS)}$ = 25A: T6405 and T6415 Series
  = 40A: T6404 and T6414 Series
- **Commutating dv/dt Capability Characterized at 400 Hz**
- **Shorted-Emitter Center-Gate Design**
- **di/dt Capability = 100 A/μs**

TERMINAL CONNECTIONS



T6404 Series
T6405 Series

Press-fit



T6414 Series
T6415 Series

Stud

MAXIMUM RATINGS, *Absolute-Maximum Values:*
For Operation with Sinusoidal Supply Voltage at 400 Hz and with Resistive or Inductive Load.

		T6404B T6405B T6414B T6415B	T6404D T6405D T6414D T6415D	
REPETITIVE PEAK OFF-STATE VOLTAGE:*	V_{DROM}			
Gate open, T_J = –50 to 110° C		200	400	V
RMS ON-STATE CURRENT (Conduction Angle = 360°):	$I_{T(RMS)}$			
Case temperature				
T_C = 85° C (T6405 Series)		25		A
80° C (T6415 Series)		25		A
70° C (T6404 Series)		40		A
65° C (T6414 Series)		40		A
For other conditions		See *Fig. 2*		
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:	I_{TSM}			
For one cycle of applied principal voltage, T_C as above				
400 Hz (sinusoidal)		600		A
60 Hz (sinusoidal)		300		A
50 Hz (sinusoidal)		265		A
For more than one cycle of applied principal voltage		See *Fig. 3*		
RATE-OF-CHANGE OF ON-STATE CURRENT:	di/dt			
$V_{DM} = V_{DROM}$, I_{GT} = 200 mA, t_r = 0.1 μs		100		A/μs
FUSING CURRENT (for Triac Protection):	I^2t			
T_J = –50 to 110° C, t = 1.25 to 10 ms		270		A^2s
PEAK GATE-TRIGGER CURRENT:■	I_{GTM}			
For 1 μs max. *(See Fig. 7)*		12		A
GATE POWER DISSIPATION:				
Peak (For 10 μs max., $I_{GTM} \leq 4$ A (peak), *(See Fig. 7)*	P_{GM}	42		W
Average	$P_{G(AV)}$	0.75		W
TEMPERATURE RANGE:▲				
Storage	T_{stg}	–50 to 150		°C
Operating (Case)	T_C	–50 to 110		°C
TERMINAL TEMPERATURE (During soldering):	T_T			
For 10 s max. (terminals and case)		225		°C
STUD TORQUE:				
Recommended	τ_s	35		in.-lb
Maximum (DO NOT EXCEED)		50		in.-lb

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* For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.
■ For either polarity of gate voltage (V_G) with reference to main terminal 1.
▲ For temperature measurement reference point, see Dimensional Outline.

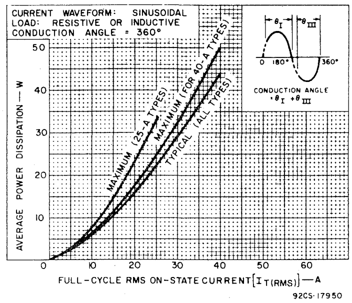


Fig. 1—Power dissipation vs. on-state current.

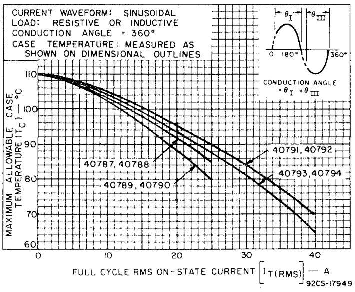


Fig. 2—Maximum allowable case temperature vs. on-state current.

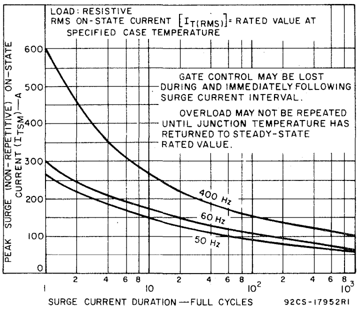


Fig. 3—Peak surge on-state current vs. surge current duration.

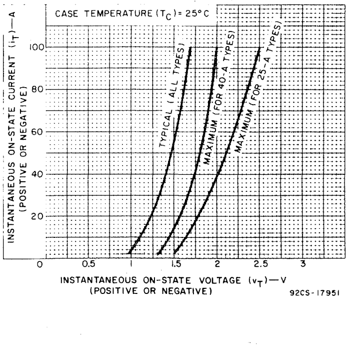


Fig. 4—On-state current vs. on-state voltage.

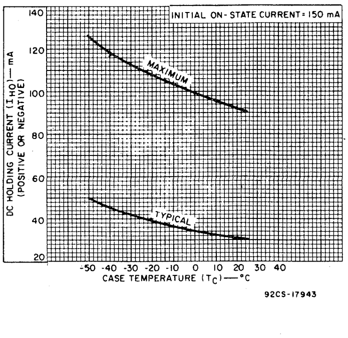


Fig. 5—DC holding current vs. case temperature.

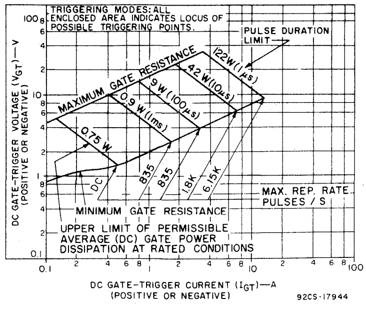


Fig. 6—Gate-trigger characteristics and limiting conditions for determination of permissible gate-trigger pulses.

T6404, T6405, T6414, T6415 Series

ELECTRICAL CHARACTERISTICS
At Maximum Ratings and at Indicated Case Temperature (T_C) Unless Otherwise Specified

CHARACTERISTIC	SYMBOL	LIMITS			UNITS
		Min.	Typ.	Max.	
Peak Off-State Current:♠					
Gate open, T_J = 110° C, V_{DROM} = Max. rated value	I_{DROM}	–	0.2	4	mA
Maximum On-State Voltage:♠ For i_T = 100 A (peak), T_C = 25° C:	V_{TM}				V
T6405 & T6415 Series		–	1.7	2.5	
T6404 & T6414 Series		–	1.7	2	
DC Holding Current:♠ Gate open, Initial principal current = 500 mA (DC), v_D = 12 V,					
T_C = 25° C	I_{HO}	–	30	90	mA
For other case temperatures			See Fig. 5		
Critical Rate-of-Rise of Commutation Voltage:♠ For v_D = V_{DROM}, $I_{T(RMS)}$ = rated value, gate unenergized,					
Commutating di/dt = 88 A/ms					
T_C = 85° C (T6405 Series)	dv/dt	2	–	–	V/µs
= 80° C (T6415 Series)		2	–	–	
Commutating di/dt = 141 A/ms					
T_C = 70° C (T6404 Series)		2	–	–	
= 65° C (T6414 Series)		2	–	–	
Critical Rate-of-Rise of Off-State Voltage:♠ For v_D = V_{DROM}, exponential voltage rise, gate open, T_C = 110° C:	dv/dt				V/µs
T6405 & T6415 Series		30	150	–	
T6404 & T6414 Series		50	200	–	
DC Gate-Trigger Current:♠† Mode, V_{MT2}, V_G For v_D = 12 V (DC), R_L = 30 Ω, T_C = 25° C					
I⁺ positive positive	I_{GT}	–	20	80	mA
III⁻ negative negative		–	50	80	
I⁻ positive negative		--	80	120	
III⁺ negative positive		–	80	120	
For other case temperatures			See Figs. 7 & 8		
DC Gate-Trigger Voltage:♠†					
For v_D = 12 V(DC), R_L = 30 Ω, T_C = 25° C	V_{GT}	–	2	3	V
For other case temperatures			See Fig. 9		
For v_D = V_{DROM}, R_L = 125 Ω, T_C = 110° C		0.2	–	–	
Gate-Controlled Turn-On Time: (Delay Time + Rise Time) For v_D = V_{DROM}, I_{GT} = 150 mA, t_r = 0.1 µs, i_T = 60 A (peak), T_C = 25° C (See Fig. 10)	t_{gt}	–	1.6	2.5	µs
Thermal Resistance, Junction-to-Case: Steady-State					
Press-fit types	$\theta_{J\text{-}C}$	–	–	0.8	°C/W
Stud		–	–	0.9	
Transient (Press-fit & stud types)			See Fig. 12		

♠ For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.

† For either polarity of gate voltage (V_G) with reference to main terminal 1.

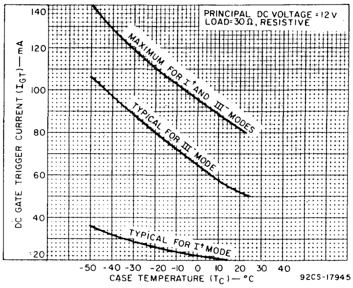


Fig. 7—DC gate-trigger current vs. case temperature (I^+ and III^- modes).

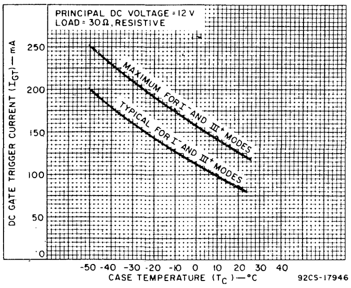


Fig. 8—DC gate-trigger current vs. case temperature (I^- and III^+ modes).

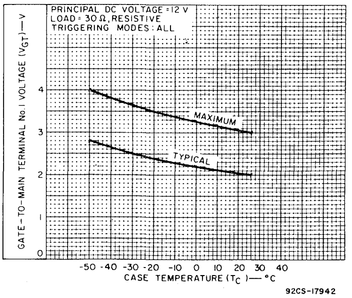


Fig. 9—DC gate-trigger voltage vs. case temperature.

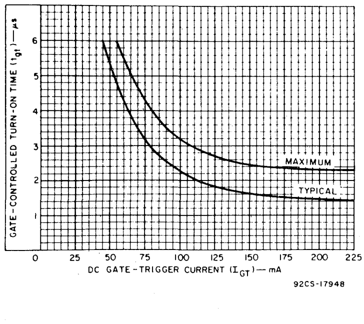


Fig. 10—Turn-on time vs. gate-trigger current.

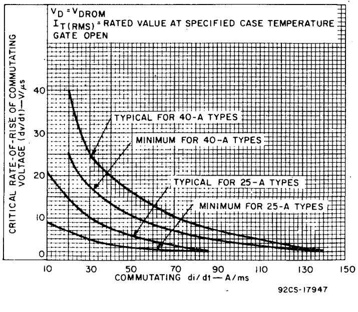


Fig. 11—Commutating voltage vs. commutating current.

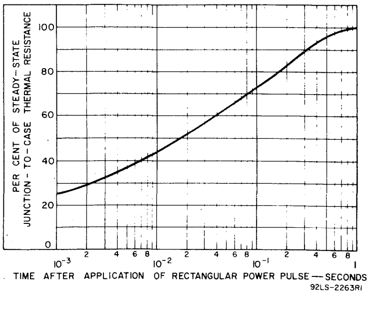


Fig. 12—Transient junction-to-case thermal resistance vs. time.

T8410, T8411, T8420, T8421 Series

60-A and 80-A Silicon Triacs

Stud and Isolated-Stud "Overmolded" Packages
For General Purpose AC Power Switching

The RCA T8410, T8411, T8420, and T8421 series triacs are gate-controlled full-wave silicon ac switches. They are designed to switch from an off-state to an on-state for either polarity of applied voltage with positive or negative gate-triggering voltages. The T8410 and T8420 series, are 80-A triacs, the T8411 and T8421 series are 60-A triacs.

These triacs are intended for control of ac loads in applications such as heating controls, motor controls, arc-welding equipment, light dimmers, and power switching systems. They can also be used in airconditioning and photocopying equipment.

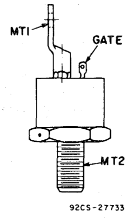
The T8410 and T8411 series employ a stud "overmolded" package. The T8420 and T8421 series employ an isolated-stud "overmolded" package.

The T8410 and T8420 series replaces the former RCA-T8440 and T8450 series.

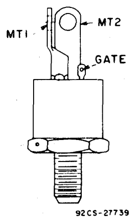
Features:

- di/dt Capability = 300 A/µs
- Shorted-Emitter Center-Gate Design
- Low Switching Losses
- Low On-State Voltage at High Current Levels
- Low Thermal Resistance
- 2.5 kV RMS Isolation (Isolated-Stud Types)

TERMINAL CONNECTIONS



Stud "overmolded" types



Isolated-Stud "overmolded" types

MAXIMUM RATINGS, *Absolute-Maximum Values:*
For Operation with Sinusoidal Supply Voltage at Frequencies Up to 50/60 Hz and with Resistive or Inductive Load.

	T8410B T8420B T8411B T8421B	T8410D T8420D T8411D T8421D	T8410M T8420M T8411M T8421M	
V_{DROM}▲:				
Gate open, T_J = −40 to 110°C	200	400	600	V
$I_{T(RMS)}$ (θ = 360°):				
T_C = 70°C (T8410 series – Stud types)		80		A
= 65°C (T8420 series – Isolated-Stud types)		80		A
= 80°C (T8411 series – Stud types)		60		A
= 75°C (T8421 series – Isolated-Stud types)		60		A
For other conditions		See Figs. 2 & 3		
I_{TSM}:				
For one cycle of applied principal voltage				
60 Hz (sinusoidal), $I_{T(RMS)}$ and T_C as above for T8410, 20 series		850		A
50 Hz (sinusoidal), $I_{T(RMS)}$ and T_C as above for T8410, 20 series		725		A
60 Hz (sinusoidal), $I_{T(RMS)}$ and T_C as above for T8411, 21 series		700		A
50 Hz (sinusoidal), $I_{T(RMS)}$ and T_C as above for T8411, 21 series		600		A
For more than one cycle of applied principal voltage		See Figs. 4 & 5		
di/dt:				
$V_{DM} = V_{DROM}$, I_{GT} = 300 mA, t_r = 0.1 µs		300		A/µs
I^2t: [At T_C shown for $I_{T(RMS)}$]:				
t = 20 ms				
T8410, T8420 series		4000		A^2s
T8411, T8421 series		2700		A^2s
t = 2.5 ms				
T8410, T8420 series		2000		A^2s
T8411, T8421 series		1350		A^2s
t = 0.5 ms				
T8410, T8420 series		1150		A^2s
T8411, T8421 series		800		A^2s
I_{GTM}●:				
For 10 µs max. (See Fig. 9).		7		A
P_{GM}:				
Peak (For 10 µs max., $I_{GTM} \leqslant 7$ A (peak), (See Fig. 9)		42		W
$P_{G(AV)}$		0.75		W
T_{stg}		−40 to 150		°C
T_C		−40 to 110		°C
T_T■:				
During soldering for 10 ms maximum (terminals and case)		225		°C
τ_s:				
Recommended		125		in-lb
		1.44		kgf-m
Maximum (DO NOT EXCEED)		150		in-lb
		1.73		kgf-m

▲For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.
● For either polarity of gate voltage (V_G) with reference to main terminal 1.
■ For temperature measurement reference point, see Dimensional Outline.

WARNING: The ceramic of the isolated stud package contains beryllium oxide. Do not crush, grind, or abrade this part because the dust resulting from such action may be hazardous if inhaled. Disposal should be by burial.

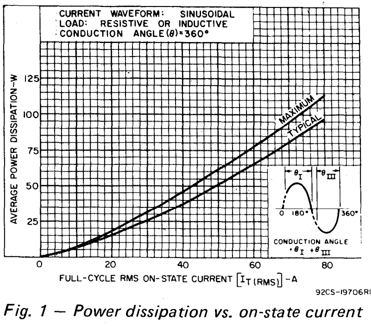


Fig. 1 – Power dissipation vs. on-state current for T8410, T8420, T8411, and T8421 series.

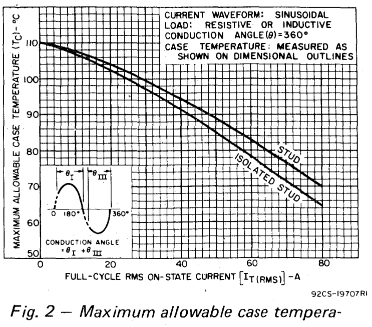


Fig. 2 – Maximum allowable case temperature vs. on-state current for T8410 and T8420 series.

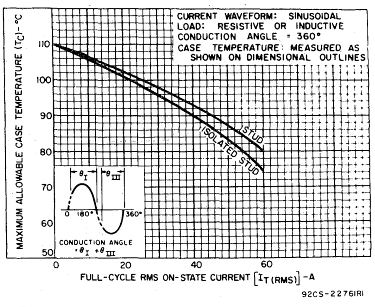


Fig. 3 – Maximum allowable case temperature vs. on-state current for T8411 and T8421 series.

T8410, T8411, T8420, T8421 Series

ELECTRICAL CHARACTERISTICS, *At Maximum Ratings Unless Otherwise Specified and at Indicated Case Temperature (T_C)*

CHARACTERISTIC	LIMITS			UNITS
	FOR ALL TYPES Except as Specified			
	Min.	Typ.	Max.	
I_{DROM}▲:				
Gate open, T_J = 110°C, V_{DROM} = Max. rated value	—	0.4	4	mA
V_{TM}▲:				
i_T = 200 A (peak), T_C = 25°C	–	1.75	2	V
i_T = 100 A (peak), T_C = 25°C	–	1.55	1.8	
I_{HO}▲:				
Gate open, Initial principal current = 500 mA (dc), v_D = 12 V				
T_C = 25°C	–	40	60	mA
= −40°C	–	–	85	
For other case temperatures *See Fig. 8*				
dv/dt (Commutating)▲:				
v_D = V_{DROM}, $I_{T(RMS)}$ = 80 A, commutating di/dt = 42 A/ms, gate unenergized				
T_C = 70°C (Stud types – T8410 series)	3	10	–	V/µs
= 65°C (Isolated-stud types – T8420 series)	3	10	–	
v_D = V_{DROM}, $I_{T(RMS)}$ = 60 A, commutating di/dt = 32 A/ms, gate unenergized				
T_C = 80°C (Stud types – T8411 series)	3	10	–	
= 75°C (Isolated-stud types – T8421 series)	3	10	–	
dv/dt (Off-State)▲:				
v_D = V_{DROM}, exponential voltage rise, gate open, T_C = 110°C:				
T8410B, T8420B, T8411B, T8421B	50	200	–	
T8410D, T8420D, T8411D, T8421D	30	150	–	V/µs
T8410M, T8420M, T8411M, T8421M	20	100	–	
I_{GT}▲●:				
v_D = 12 V dc, R_L = 30Ω, T_C = 25°C				
Mode V_{MT2} V_G				
I^+ positive positive	–	20	75	
III^- negative negative	–	40	75	
I^- positive negative	–	40	150	
III^+ negative positive	–	100	150	
v_D = 12 V dc, R_L = 30Ω, T_C = −40°C				mA
Mode V_{MT2} V_G				
I^+ positive positive	–	35	150	
III^- negative negative	–	80	150	
I^- positive negative	–	100	400	
III^+ negative positive	–	280	400	
For other case temperatures *See Figs. 10 & 11*				
V_{GT}▲●:				
v_D = 12 V dc, R_L = 30Ω, T_C = 25°C	–	1.35	2.5	V
For other case temperatures *See Fig. 12*				
t_{gt}: v_D = V_{DROM}, I_{GT} = 300 mA, t_r = 0.1 µs, T_C = 25°C,				
i_T = 85 A(peak) (T8411, T8421 series)	–	1.2	2.5	µs
=112 A(peak) (T8410, T8420 series)	–	1.2	2.5	
$R_{\theta JC}$:				
Steady-State				
Stud types	–	–	0.35	°C
Isolated-stud types	–	–	0.4	
Transient *See Fig. 14*				

▲ For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.
● For either polarity of gate voltage (V_G) with reference to main terminal 1.
■ For temperature measurement reference point, see Dimensional Outline.

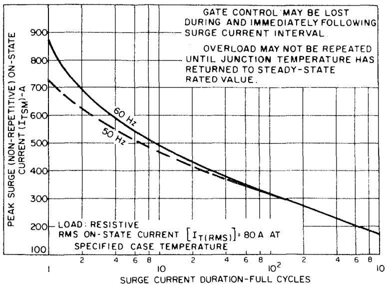


Fig. 4 — Peak surge on-state current vs. surge current duration for T8410 and T8420 series.

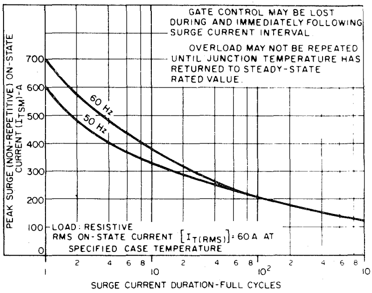


Fig. 5 — Peak surge on-state current vs. surge current duration for T8411 and T8421 series.

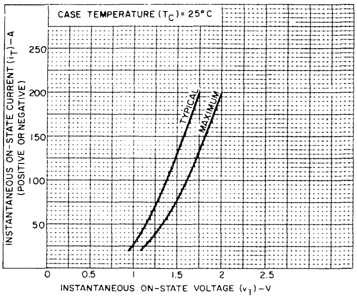


Fig. 6 — On-state current vs. on-state voltage for T8410 and T8420 series.

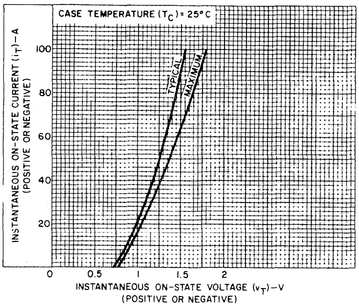


Fig. 7 — On-state current vs. on-state voltage for T8411 and T8421 series.

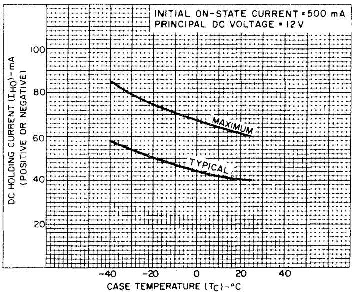


Fig. 8 — DC holding current vs. case temperature for all series.

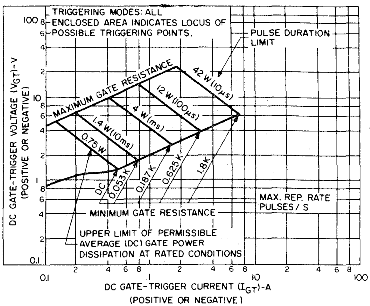


Fig. 9 — Gate-trigger characteristics and limiting conditions for determination of permissible gate-trigger pulses for all series.

T8410, T8411, T8420, T8421 Series

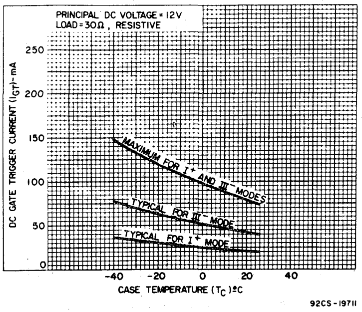


Fig. 10 – DC gate-trigger current vs. case temperature (I^+ and III^- modes) for all series.

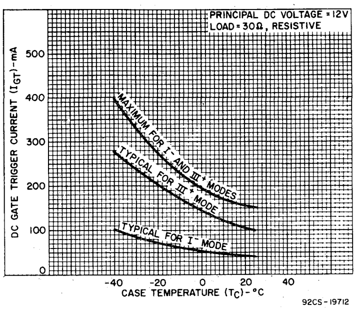


Fig. 11 – DC gate-trigger current vs. case temperature (I^- and III^+ modes) for all series.

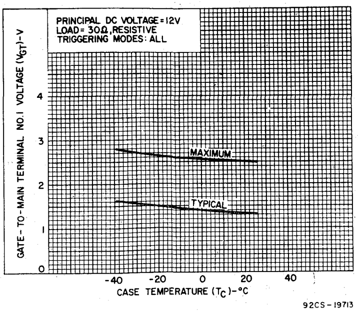


Fig. 12 – DC gate-trigger voltage vs. case temperature for all series.

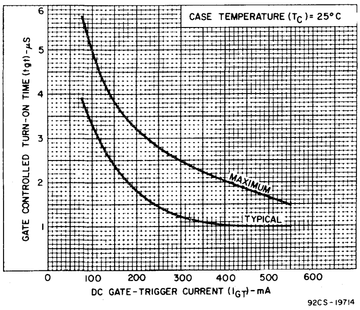


Fig. 13 – Turn-on time vs. gate-trigger current for all series.

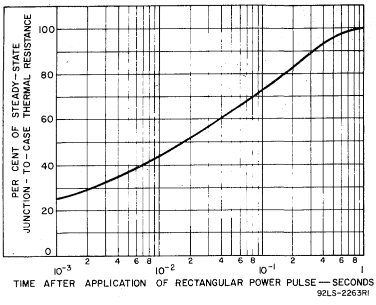


Fig. 14 – Transient junction-to-case thermal resistance vs. time for all series.

Zero-Voltage-Switched Types

2.5-40 A, 100-600 V Silicon Triacs for Use With IC Zero-Voltage Switches

For Power-Control and Switching Applications at 50-60 Hz with RCA-CA3058, CA3059, or CA3079 IC as Trigger Circuits

The triacs listed below are gate-controlled full-wave ac switches intended for load-control applications. They are especially useful in ac circuits for heating controls (proportional or on-off), lamp switching, motor switching, and a wide variety of other power-control applications.

These devices have gate characteristics which assure that an RCA-CA3058, CA3059, or CA3079 integrated circuit can supply sufficient drive current to trigger them over their full operating-temperature range (−40°C to +85°C).

The RCA-CA3058, CA3059, and CA3079 are monolithic silicon integrated-circuit zero-voltage switches which can operate directly from the ac line. They are designed to drive the triac gate directly and provide the gating signal at zero-voltage crossings for minimum radio-frequency interference.

These triacs have rms on-state current ratings that range from 2.5 to 40 amperes, and repetitive off-state voltage ratings from 100 to 600 volts. They are supplied in a variety of packages.

Technical information on RCA-CA3058, CA3059, and CA3079 is contained in bulletin File No. 490. For detailed application information, see Application Note ICAN-6182, "Features and Application of RCA Integrated-Circuit Zero-Voltage Switches".

WARNING: The ceramic of the isolated stud package contains beryllium oxide. Do not crush, grind, or abrade this part because the dust resulting from such action may be hazardous if inhaled. Disposal should be by burial.

RATINGS AND CHARACTERISTICS

All types, at case temperature (T_C) = 25°C, I^+ and III^+ triggering modes,▲ I_{GT} = 45 mA max., V_{GT} = 1.5 V max.

Type No.	Rep. Peak Off-State Voltage V_{DROM} (V)	RMS On-State Current $I_{T(RMS)}$ at Case Temp. (A)	(°C)	Typ. DC Holding Current at 25°C, I_{HO} (mA)	Package	Additional Data Shown in Bulletin File No.*
T2306A	100	2.5	70	6	Mod. TO-5	414
T2306B	200	2.5	70	6		414
T2306D	400	2.5	70	6		414
T2316A	100	2.5	70	6	Mod. TO-5 on Heat Radiator	414
T2316B	200	2.5	70	6		414
T2316D	400	2.5	70	6		414
T2506B	200	6	80	15	TO-220AB	615
T2506D	400	6	80	15		615
T2706B	200	6	75	15	TO-66	351
T2706D	400	6	75	15		351
T2716B	200	6	75	15	TO-66 with Heat Radiator	351
T2716D	400	6	75	15		351
T2806B	200	8	80	15	TO-220AB	364
T2806D	400	8	80	15		364
T2856B	200	8	75	15	Isolated-Tab TO-220AB	540
T2856D	400	8	75	15		540
T4106B	200	15	80	20	Press-fit	458
T4106D	400	15	80	20		458
T4106M	600	15	80	20		458
T4107B	200	10	85	15	Press-fit	457
T4107D	400	10	85	15		457
T4107M	600	10	85	15		457
T4116B	200	15	80	20	Stud	458
T4116D	400	15	80	20		458
T4116M	600	15	80	20		458
T4117B	200	10	85	15	Stud	457
T4117D	400	10	85	15		457
T4117M	600	10	85	15		457
T4126B	200	15	75	20	Isolated Stud	458
T4126D	400	15	75	20		458
T4126M	600	15	75	20		458
T4127B	200	10	85	15	Isolated Stud	457
T4127D	400	10	85	15		457
T4127M	600	10	85	15		457
T6406B	200	40	70	45	Press-fit	593
T6406D	400	40	70	45		593
T6406M	600	40	70	45		593
T6407B	200	30	65	25	Press-fit	459
T6407D	400	30	65	25		459
T6407M	600	30	65	25		459
T6416B	200	40	65	25	Stud	593
T6416D	400	40	65	25		593
T6416M	600	40	65	25		593
T6417B	200	30	60	25	Stud	459
T6417D	400	30	60	25		459
T6417M	600	30	60	25		459
T6426B	200	40	60	25	Isolated Stud	593
T6426D	400	40	60	25		593
T6426M	600	40	60	25		593
T6427B	200	30	55	25	Isolated Stud	459
T6427D	400	30	55	25		459
T6427M	600	30	55	25		459

▲ A triac driven directly from the output terminal of the CA3058, CA3059, or CA3079 should be characterized for operation in the I^+ or III^+ triggering mode, i.e., with positive gate current (current flows into the gate for both polarities of the applied ac voltage).

* Except for gate characteristics, data in these bulletins also apply to the types listed in this chart.

Silicon Controlled Rectifiers (SCR's)

Technical Data

C106, C107, C108 Series

4-A Sensitive-Gate Silicon Controlled Rectifiers

For Power-Switching and Control Applications

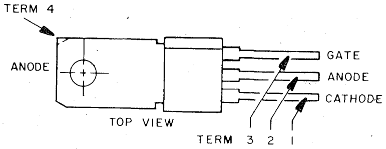
The RCA-C106, C107, and C108 series of sensitive-gate silicon controlled rectifiers are designed for switching ac and dc currents. These SCR's are divided into the three different series according to gate sensitivity. The types within each series differ in their voltage ratings; the voltage ratings are identified by suffix letters in the type designations.

These SCR's have microampere gate-current requirements which permit operation with low-level logic circuits. They can be used for lighting, power-switching, and motor-speed controls, and for gate-current amplification for driving larger SCR's.

All types in each series utilize the JEDEC-TO-202AB (RCA VERSATAB) plastic package.

Features:

- Microampere gate sensitivity
- 600-V capability
- 5-A (rms) on-state current ratings
- 30-A peak surge capability
- Glass-passivated chip for stability
- Low thermal resistances
- Surge capability curve
- Package and formed-lead options available



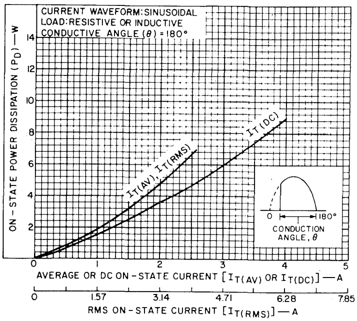
92CS-29320

JEDEC TO-202AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

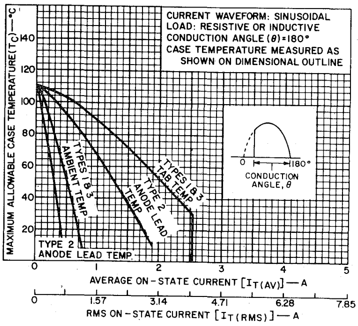
	C160Q C107Q C108Q	C106Y C107Y C108Y	C106F C107F C108F	C106A C107A C108A	C106B C107B C108B	C106C C107C C108C	C106D C107D C108D	C106E C107E C108E	C106M C107M C108M	
V_{RSXM}: R_{GK} = 1000 Ω, T_C = −40 to 110°C V_{DSXM}: R_{GK} = 1000 Ω, T_C = −40 to 110°C	25	50	75	125	250	400	500	600	700	V
V_{RRXM}: R_{GK} = 1000 Ω, T_C = −40 to 110°C V_{DRXM}: R_{GK} = 1000 Ω, T_C = −40 to 110°C	15	30	50	100	200	300	400	500	600	V

	C106 Series	C107 Series	C108 Series	
$I_{T(AV)}$ (T_C = 45°C, θ = 180°)	2.2	2	3.3	A
$I_{T(RMS)}$ (T_C = 45°C, θ = 180°)	3.5	3.14	5	A
$I_{T(DC)}$ (T_C = 70°C)	2.6	2.4	4	A
I_{TSM}:				
For one cycle of applied principal voltage, T_C = 45°C				
60 Hz (sinusoidal)	20	15	30	A
50 Hz (sinusoidal)	18.5	14	28	A
For more than one cycle of applied principal voltage		See Fig. 11		
I_{GM} (t = 10 μs)		0.2		A
V_{GRM}		6		V
di/dt:				
$V_{DM}=V_{DROM}$, I_{GT} = 1 mA, t_r = 0.5 μs, T_C = 110°C		100		A/μs
I^2t [At T_C shown for $I_{T(RMS)}$]:				
t = 10 ms	1.77	1	4	A^2s
8.33 ms	1.67	0.94	3.75	A^2s
1 ms	0.82	0.46	1.85	A^2s
P_{GM} (For 10 μs max.)		0.5		W
$P_{G(AV)}$ (Averaging time = 10 ms max.)		0.1		W
T_{stg}		−40 to +150		°C
T_C		−40 to +110		°C
T_T (During soldering for 10 s max.		250		°C



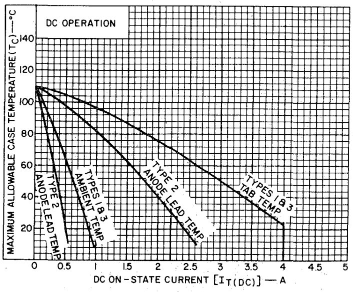
92CS-29203

Fig. 1 — Power dissipation as a function of average dc, or rms on-state current for C106 series.



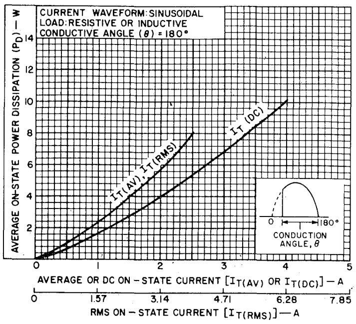
92CS-29204

Fig. 2 — Maximum allowable case temperature as a function of average or rms on-state current for C106 series.



92CS-29205

Fig. 3 — Maximum allowable case temperature as a function of dc on-state current for C106 series.



92CS-29206

Fig. 4 — Power dissipation as a function of average, dc, or rms on-state current for C107 series.

C106, C107, C108 Series

ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	LIMITS FOR ALL TYPES UNLESS OTHERWISE SPECIFIED Min.	Typ.	Max.	UNITS
I_{DRXM} or I_{RRXM}: $V_D = V_{DRXM}$ or $V_R = V_{RRXM}$, $R_{GK} = 1000\ \Omega$ $T_C = 25^oC$ . . . . $T_C = 110^oC$	– –	0.1 10	10 100	µA
v_T: For $i_T = 4$ A and $T_C = 25^oC$ (See Fig. 13) C106 Series C107 Series For $i_T = 5$ A and $T_C = 25^oC$ (See Fig. 13) C108 Series	– – –	1.25 – –	2.2 2.5 1.35	V
i_{HX}: R_{GK}=1000 Ω, V_D=12 V, $I_{T(INITIAL)}$=50 mA, T_C=25°C: All Series	–	1.7	3	mA
I_{LX}: $R_{GK} = 1000\ \Omega$, $V_D = 12$ V, $T_C = 25^oC$: C106, C108 Series ($I_{GT} = 200\ \mu A$) . . . . C107 Series ($I_{GT} = 500\ \mu A$)	– –	1.8 –	4 4	mA
dv/dt: V_D=V_{DRXM}, R_{GK}=1000 Ω, Exponential rise, T_C=110°C	–	8	–	V/µs
I_{GT}: V_D=12 V dc, R_L=30 Ω, T_C=25°C: C106, C108 Series . . . . C107 Series . . . . For other case temperatures.	– – See Figs. 18,19	30 –	200 500	µA
V_{GT}: $V_D = 12$ V dc, $R_L = 30\ \Omega$, $T_C = 25^oC$ . . . . For other case temperatures.	– See Fig. 20	0.5	0.8	V
t_{gt}: $V_D = V_{DRXM}$, $i_T = 1$ A, $R_{GK} = 1000\ \Omega$, $I_{GT} = 1$ mA, Rise Time = 0.1 µs, $T_C = 25^oC$.	–	1.7	2.5	µs
t_q: $V_D = V_{DRXM}$, $i_T = 1$ A, $R_{GK} = 1000\ \Omega$, Pulse Duration = 50 µs, dv/dt = 5 V/µs, di/dt = –10 A/µs, $I_{GT} = 1$ mA at turn-on, $T_C = 110^oC$ . .	–	30	100	µs
$R_{\theta JC}$ . . . . $R_{\theta JA}$	– –	– –	8 60	°C/W

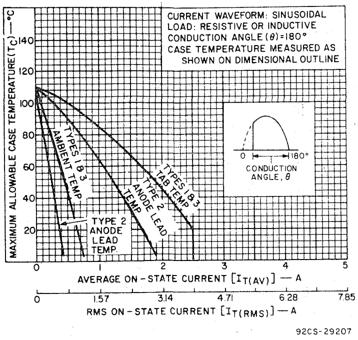


Fig. 5 — Maximum allowable case temperature as a function of average or rms on-state current for C107 series.

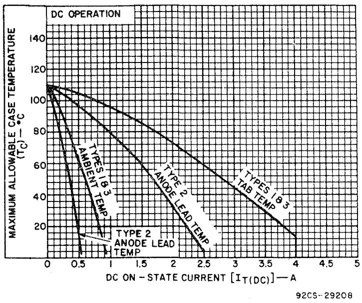


Fig. 6 — Maximum allowable case temperature as a function of dc on-state current for C107 series.

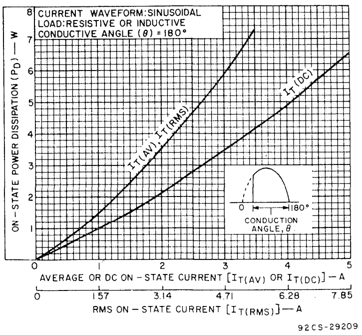


Fig. 7 — Power dissipation as a function of average, dc, or rms on-state current for C108 series.

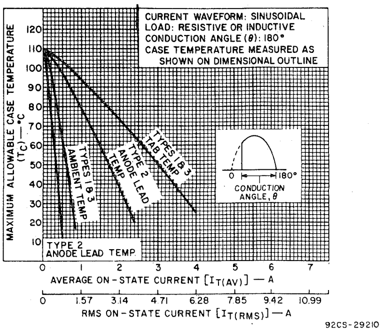


Fig. 8 — Maximum allowable case temperature as a function of average or rms on-state current for C108 series.

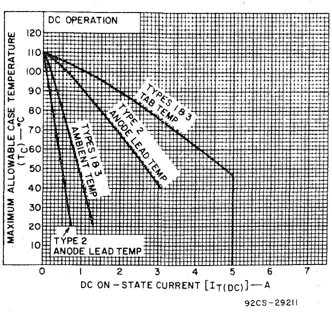


Fig. 9 — Maximum allowable case temperature as a function of dc on-state current for C108 series.

C106, C107, C108 Series

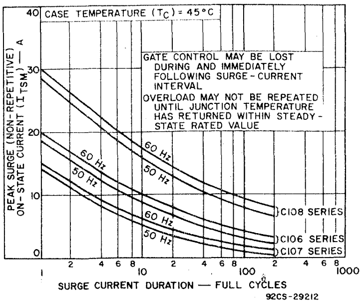


Fig. 10 — Peak surge on-state current as a function of surge current duration.

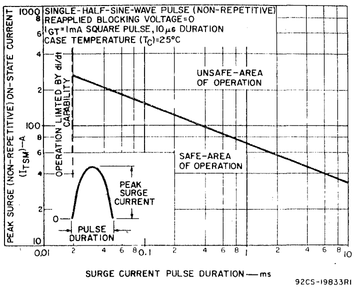


Fig. 11 — Surge capability without reapplied blocking voltage for all series.

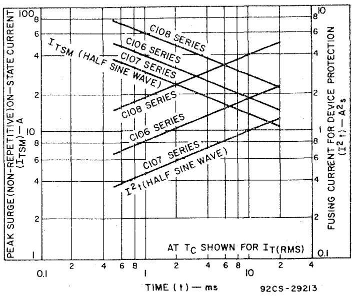


Fig. 12 — Peak surge on-state current and fusing current as a function of time.

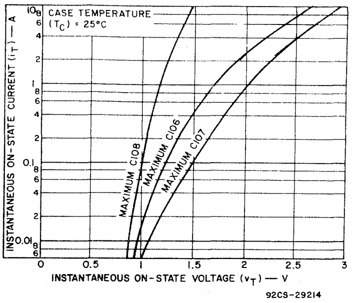


Fig. 13 — Maximum instantaneous on-state current as a function of on-state voltage.

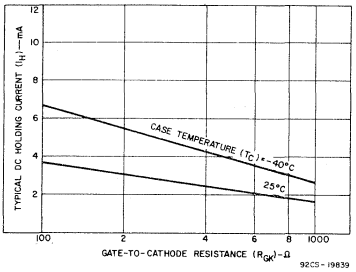


Fig. 14 — DC holding current as a function of gate-cathode resistance for the C106 series.

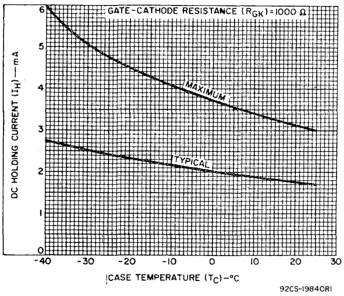


Fig. 15 — DC holding current as a function of case temperature for the C106 series.

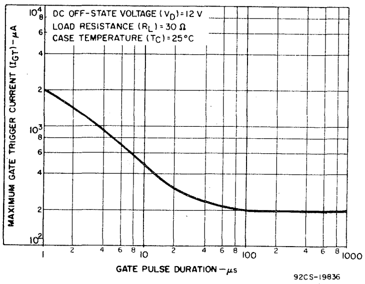


Fig. 16 — Maximum gate trigger current as a function of pulse duration for types in the C106 series.

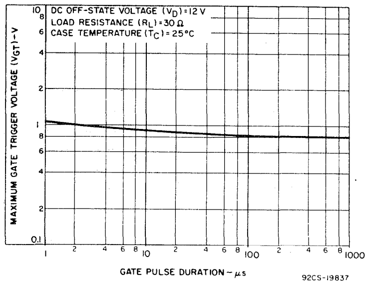


Fig. 17 — Maximum gate trigger voltage as a function of gate pulse duration for types in the C106 series.

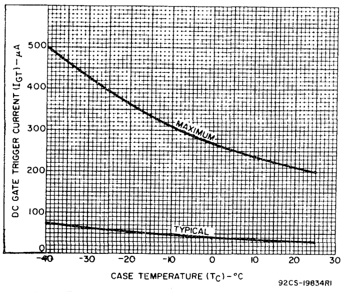


Fig. 18 — DC gate trigger current as a function of case temperature for C106 and C108 series.

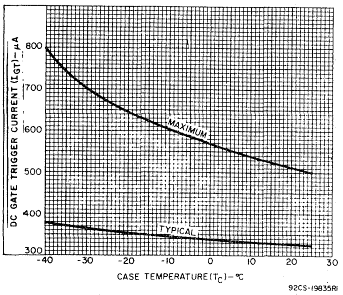


Fig. 19 — DC gate-trigger current as a function of case temperature for C107 series.

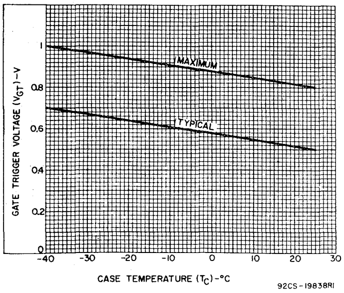


Fig. 20 — Gate trigger voltage as a function of case temperature for all series.

S106, S107, S108 Series

4-A Sensitive-Gate Silicon Controlled Rectifiers

For Power Switching and Control Applications

The S106, S107, and S108 series of sensitive-gate silicon controlled rectifiers are designed for switching ac and dc currents. These SCR's are divided into the three different series according to gate sensitivity. The types within each series differ in their voltage ratings; the voltage ratings are identified by suffix letters in the type designations.

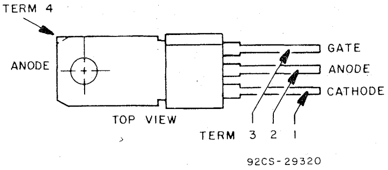
These thyristors have microampere gate-current requirements which permit operation with low-level logic circuits. They can be used for lighting, power-switching, and motor-speed controls, and for gate-current amplification for driving larger SCR's.

All types in each series utilize the JEDEC TO-202AB (RCA VERSATAB) plastic package.

Features:

- Microampere gate sensitivity
- Minimum gate current specified for the S108 series
- 600-V capability
- 4-A (rms) on-state current ratings
- 20-A peak surge capability
- Glass-passivated chip for stability
- Low thermal resistances
- Surge capability curve

TERMINAL DESIGNATIONS



JEDEC TO-202AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	S106Q S107Q S108Q	S106Y S107Y S108Y	S106F S107F S108F	S106A S107A S108A	S106B S107B S108B	S106C S107C S108C	S106D S107D S108D	S106E S107E S108E	S106M S107M S108M	
V_{RSXM}: R_{GK} = 1000 Ω, T_C = −40 to 110°C V_{DSXM}: R_{GK} = 1000 Ω, T_C = −40 to 110°C	25	50	75	125	250	400	500	600	700	V
V_{RRXM}: R_{GK} = 1000 Ω, T_C = −40 to 110°C V_{DRXM}: R_{GK} = 1000 Ω, T_C = −40 to 110°C	15	30	50	100	200	300	400	500	600	V
$I_{T(AV)}$ (T_C = 60°C, θ = 180°)	2.5									A
$I_{T(RMS)}$ (T_C = 60°C, θ = 180°)	4									A
$I_{T(DC)}$ (T_C = 70°C)	2.75									A
I_{TSM}:										
For one cycle of applied principal voltage, T_C=60°C										
60 Hz (sinusoidal)	20									A
50 Hz (sinusoidal)	17									A
For more than one cycle of applied principal voltage	See Fig. 5									
I_{GM} (t = 10 μs)	0.2									A
V_{GRM}	6									V
di/dt:										
V_{DM}=V_{DROM}, I_{GT} = 1 mA, t_r = 0.5 μs, T_C = 110°C	100									A/μs
I^2t [At T_C shown for $I_{T(RMS)}$]:										
t = 10 ms	1.7									A^2s
1 ms	0.8									A^2s
P_{GM} (For 10 μs max.)	0.5									W
$P_{G(AV)}$ (Averaging time = 10 ms max.)	0.1									W
T_{stg}	−40 to +150									°C
T_C	−40 to +110									°C
T_T (During soldering for 10 s max.	250									°C

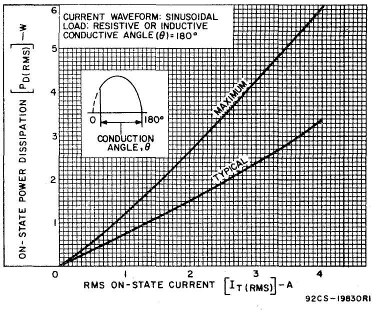


Fig. 1 — Power dissipation as a function of rms-on-state current for all series.

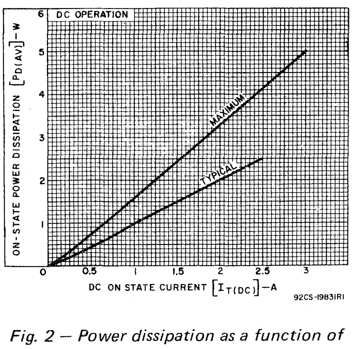


Fig. 2 — Power dissipation as a function of dc on-state current for all series.

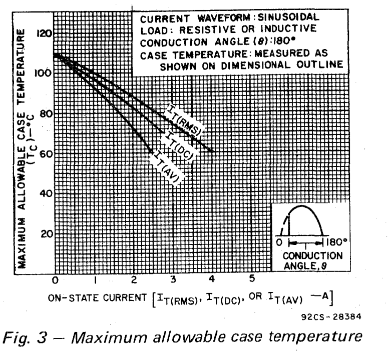


Fig. 3 — Maximum allowable case temperature as a function of on-state current for all series.

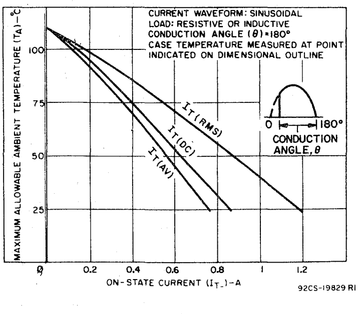


Fig. 4 — Maximum allowable ambient temperature as a function of on-state current for all series.

S106, S107, S108 Series

ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	LIMITS FOR ALL TYPES UNLESS OTHERWISE SPECIFIED			UNITS
	Min.	Typ.	Max.	
I_{DRXM} or I_{RRXM}: $V_D=V_{DRXM}$ or $V_R=V_{RRXM}$, $R_{GK}=1000\ \Omega$				
$T_C=25^oC$	–	0.1	10	μA
$T_C=110^oC$	–	10	100	
v_T: For $i_T=4$ A and $T_C=25^oC$ (See Fig. 8)	–	1.25	2.2	V
i_{HX}: $R_{GK}=1000\ \Omega$, $V_D=12$ V, $I_{T(INITIAL)}=50$ mA, $T_C=25^oC$:				
S106 Series	–	1.7	3	mA
S107 Series	–	3.9	6	
S108 Series	–	6	10	
i_{LX}: $R_{GK}=1000\ \Omega$, $V_D=12$ V, $T_C=25^oC$:				
S106 Series ($I_{GT}=200\ \mu A$)	–	1.8	4	mA
S107 Series ($I_{GT}=500\ \mu A$)	–	2.5	8	
S108 Series ($I_{GT}=2000\ \mu A$)	–	8	12	
dv/dt: $V_D=V_{DRXM}$, $R_{GK}=1000\ \Omega$, Exponential rise, $T_C=110^oC$	–	8	–	V/μs
I_{GT}: $V_D=12$ V dc, $R_L=30\ \Omega$, $T_C=25^oC$:				
S106 Series	–	30	200	μA
S107 Series	–	–	500	
S108 Series	100	–	2000	
For other case temperatures	See Figs. 13, 14, 15			
V_{GT}: $V_D=12$ V dc, $R_L=30\ \Omega$, $T_C=25^oC$	–	0.5	0.8	V
For other case temperatures		See Fig. 16		
t_{gt}: $V_D=V_{DRXM}$, $i_T=1$ A, $R_{GK}=1000\ \Omega$, $I_{GT}=1$ mA, Rise Time=0.1 μs, $T_C=25^oC$	–	1.7	2.5	μs
t_q: $V_D=V_{DRXM}$, $i_T=1$ A, $R_{GK}=1000\ \Omega$, Pulse Duration=50 μs, dv/dt=5 V/μs, di/dt=–10 A/μs, $I_{GT}=1$ mA at turn-on, $T_C=110^oC$	–	30	100	μs
$R_{\theta JC}$	–	–	8	°C/W
$R_{\theta JA}$	–	–	60	

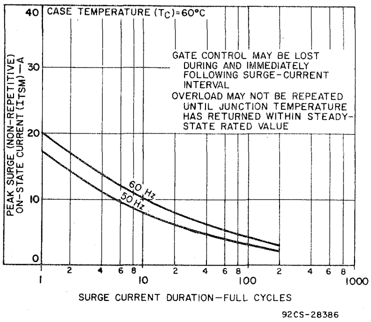


Fig. 5 – Peak surge on-state current as a function of surge-current duration for all series.

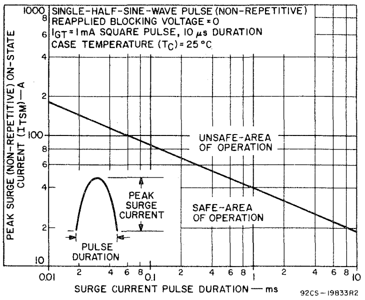


Fig. 6 – Surge capability without reapplied blocking voltage for all series.

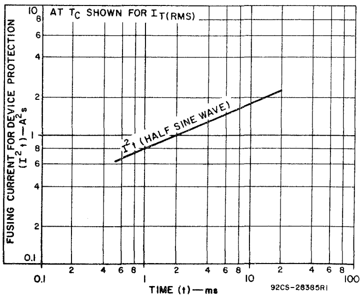


Fig. 7 – Fusing current as a function of time.

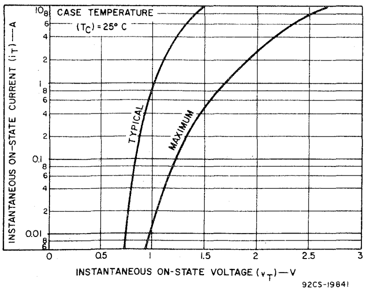


Fig. 8 – Instantaneous on-state current as a function of on-state voltage for all series.

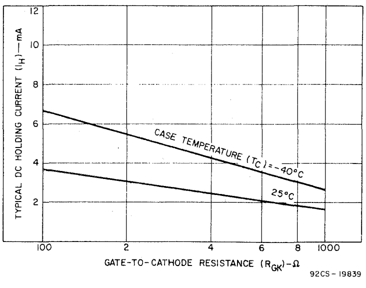


Fig. 9 – DC holding current as a function of gate-cathode resistance for the S106 series.

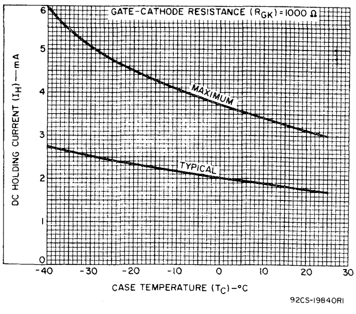


Fig. 10 – DC holding current as a function of case temperature for the S106 series.

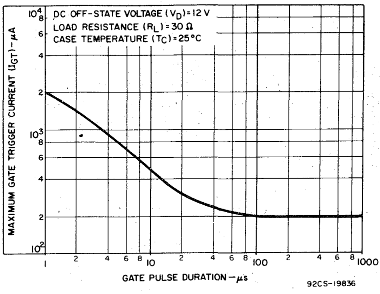


Fig. 11 – Maximum gate trigger current as a function of gate pulse duration for types in the S106 series.

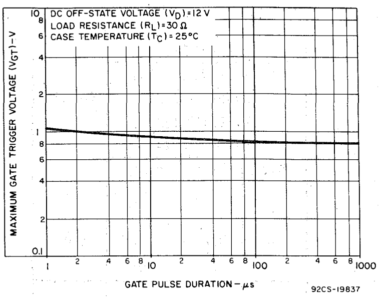


Fig. 12 – Maximum gate trigger voltage as a function of gate pulse duration for types in the S106 series.

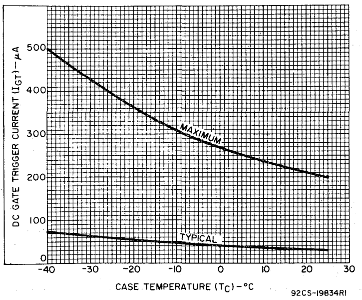


Fig. 13 – DC gate trigger current as a function of case temperature for S106 series.

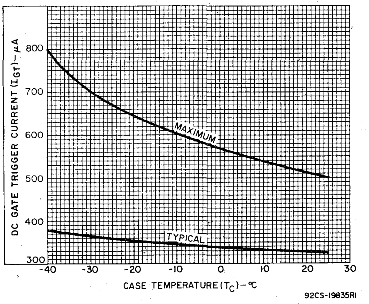


Fig. 14 – DC gate trigger current as a function of case temperature for S107 series.

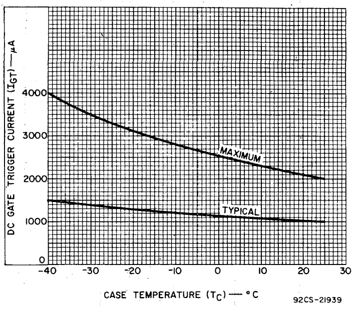


Fig. 15 – DC gate trigger current as a function of case temperature for S108 series.

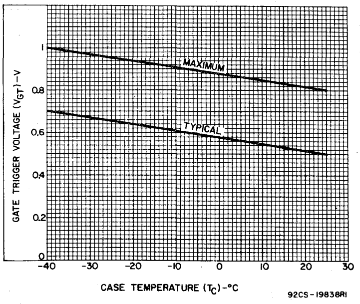


Fig. 16 – Gate trigger voltage as a function of case temperature for all series.

S2060, S2061, S2062 Series

4-A Sensitive-Gate Silicon Controlled Rectifiers

For Power Switching and Control Applications

The S2060, S2061, and S2062 series• are sensitive-gate silicon controlled rectifiers designed for switching ac and dc currents. These SCR's are divided into the three different series according to gate sensitivity. The types within each series differ in their voltage ratings; the voltage ratings are identified by suffix letters in the type designations.

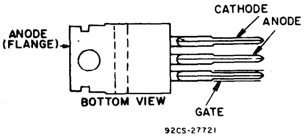
These thyristors have microampere gate-current requirements which permit operation with low-level logic circuits. They can be used for lighting, power-switching, and motor-speed controls, and for gate-current amplification for driving larger SCR's.

All types in each series utilize the JEDEC TO-220AB package. Upon request, each type is available in either of two variants of the TO-220AB package. For information on these package variations, contact the RCA Sales Office in your locale.

Features:

- Microampere gate sensitivity
- Minimum gate current specified for the S2062 series
- 600-V capability
- 4-A (rms) on-state current ratings
- 35-A peak surge capability
- Glass-passivated chip for stability
- Low thermal resistances
- Surge capability curve

TERMINAL CONNECTIONS



JEDEC TO-220AB

• Formerly the RCA106, RCA107, and RCA108 series.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		Suffix Letter									
		Q	Y	F	A	B	C	D	E	M	
NON-REPETITIVE PEAK REVERSE VOLTAGE											
R_{GK} = 1000 Ω, T_C = -40 to 110°C	V_{RSXM}										
NON-REPETITIVE PEAK OFF-STATE VOLTAGE		25	50	75	125	250	400	500	600	700	V
R_{GK} = 1000 Ω, T_C = -40 to 110°C	V_{DSXM}										
REPETITIVE PEAK REVERSE VOLTAGE											
R_{GK} = 1000 Ω, T_C = -40 to 110°C	V_{RRXM}										
REPETITIVE PEAK OFF-STATE VOLTAGE		15	30	50	100	200	300	400	500	600	V
R_{GK} = 1000 Ω, T_C = -40 to 110°C	V_{DRXM}										
ON-STATE CURRENT:											
Conduction angle = 180°, T_C = 85°C											
Average ac value	$I_{T(AV)}$	2.5									A
RMS value	$I_{T(RMS)}$	4									A
DC operation	$I_{T(DC)}$	2.75									A
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:	I_{TSM}										
For one cycle of applied principal voltage , T_C = 85°C											
60 Hz (sinusoidal)		35									A
50 Hz (sinusoidal)		28									A
60 Hz (sinusoidal)	I_{TSM}	35									A
For more than one cycle of applied principal voltage		See Fig. 5									
PEAK GATE CURRENT (t = 10 μsec)	I_{GM}	0.2									A
PEAK GATE REVERSE VOLTAGE	V_{RGM}	6									V
RATE OF CHANGE OF ON-STATE CURRENT:											
$V_{DM} = V_{DROM}$, I_{GT} = 1 mA, t_r = 0.5 μs, T_C = 110°C	di/dt	100									A/μs
FUSING CURRENT (for SCR protection):											
T_J = −40 to 110°C, t = 1 to 8.3 ms	I^2t	2.6									A^2s
GATE POWER DISSIPATION:											
PEAK FORWARD (for 10 μs max.)	P_{GM}	0.5									W
AVERAGE (averaging time = 10 ms max.)	$P_{G(AV)}$	0.1									W
TEMPERATURE RANGE:											
Storage	T_{stg}	-40 to +150									°C
Operating (case)*	T_C	-40 to +110									°C
TERMINAL TEMPERATURE (During soldering):											
For 10 s max.	T_T	250									°C

*Temperature measuring point is shown in the dimensional outline .

ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	LIMITS FOR ALL TYPES UNLESS OTHERWISE SPECIFIED			UNITS
		MIN.	TYP.	MAX.	
PEAK OFF-STATE CURRENT:					
Forward, $V_D = V_{DRXM}$, R_{GK} = 1000 Ω T_C = 25°C T_C = 110°C	I_{DRXM}	– –	0.1 10	10 100	μA
Reverse, $V_R = V_{RRXM}$, R_{GK} = 1000 Ω T_C = 25°C T_C = 100°C	I_{RRXM}	– –	0.1 10	10 100	
INSTANTANEOUS ON-STATE VOLTAGE: For i_T = 4 A and T_C = 25°C (See Fig. 7)	v_T	–	1.25	2.2	V
DC GATE TRIGGER CURRENT: V_D = 12 V (dc), R_L = 30 Ω, T_C = 25°C:					
S2060 Series S2061 Series S2062 Series	I_{GT}	– – 100	– – –	200 500 2000	μA
For other case temperatures		See Figs. 10,11,12			
DC GATE TRIGGER VOLTAGE: V_D = 12 V (dc), R_L = 30 Ω, T_C = 25°C	V_{GT}	–	0.5	0.8	V
For other case temperatures		See Fig. 14			
INSTANTANEOUS HOLDING CURRENT: R_{GK} = 1000 Ω, V_D = 12 V, $I_{T\ (INITIAL)}$ = 50 mA, T_C = 25°C:					
S2060 Series S2061 Series S2062 Series	i_H	– – –	1.7 3.9 6	3 6 10	mA

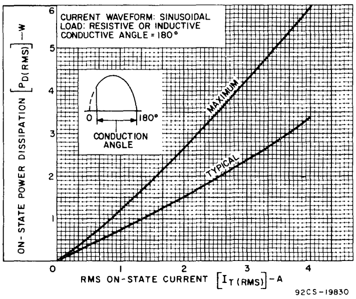


Fig. 1—Power dissipation vs. rms-on-state current for all series.

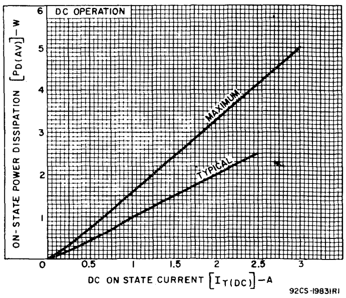


Fig. 2—Power dissipation vs. dc on-state current for all series.

S2060, S2061, S2062 Series

ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	LIMITS FOR ALL TYPES UNLESS OTHERWISE SPECIFIED MIN.	 TYP.	 MAX.	UNITS
LATCHING CURRENT: R_{GK} = 1000 Ω, V_D = 12 V, T_C = 25°C:					
S2060 Series (I_{GT} = 200 μA)	i_L	–	1.8	4	mA
S2061 Series (I_{GT} = 500 μA)		–	2.5	8	
S2062 Series (I_{GT} = 2000 μA)		–	8	12	
CRITICAL RATE OF RISE OF OFF-STATE VOLTAGE: V_D = V_{DRXM}, R_{GK} = 1000 Ω, Exponential rise, T_C = 110°C	dv/dt	5	8	–	V/μs
GATE-CONTROLLED TURN-ON TIME: V_D = V_{DRXM}, i_T = 1 A, R_{GK} = 1000 Ω, I_{GT} = 1 mA, rise time = 0.1 μs, T_C = 25°C	t_{gt}	–	1.7	2.5	μs
CIRCUIT COMMUTATED TURN-OFF TIME: V_D = V_{DRXM}, i_T = 1 A, R_{GK} = 1000 Ω, Pulse Duration = 50 μs, dv/dt = 5 V/μs, di/dt = –10 A/μs, I_{GT} = 1 mA at turn on, T_C = 110°C	t_q	–	30	100	μs
THERMAL RESISTANCE: Junction-to-Case*	$R_{\theta JC}$	–	–	3.5	°C/W
Junction-to-Ambient	$R_{\theta JA}$	–	–	60	

* Temperature measuring point is shown in the dimensional outline,

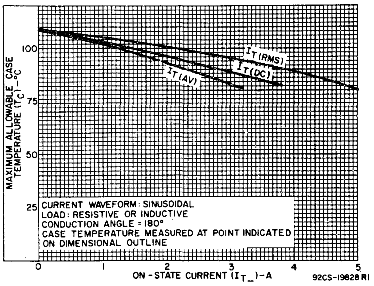


Fig. 3—Maximum allowable case temperature vs. on-state current for all series.

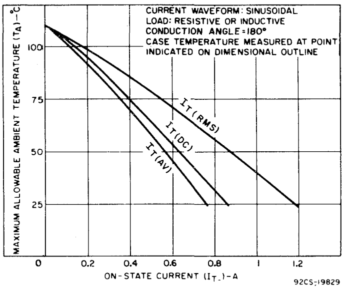


Fig. 4—Maximum allowable ambient temperature vs. on-state current for all series.

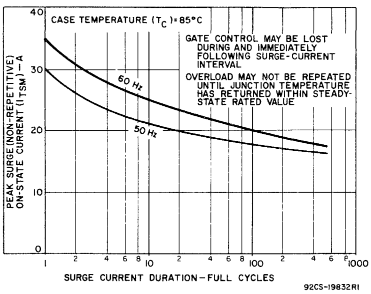


Fig. 5—Peak surge on-state current vs. surge-current duration for all series.

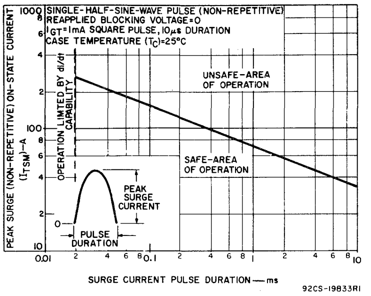


Fig. 6—Surge capability without reapplied blocking voltage for all series.

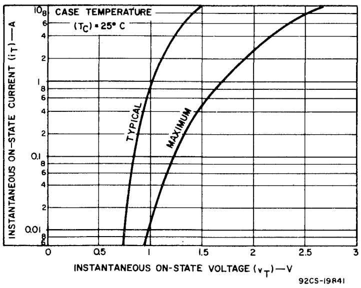


Fig. 7—Instantaneous on-state current vs. on-state voltage for all series.

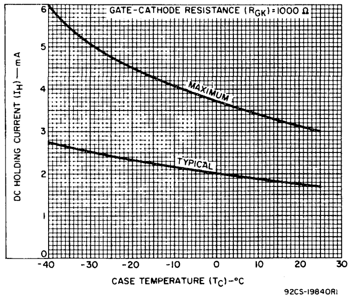


Fig. 8—DC holding current vs. case temperature for the S2060 series.

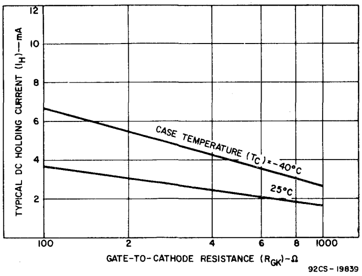


Fig. 9—DC holding current vs. gate-cathode resistance for the S2060 series.

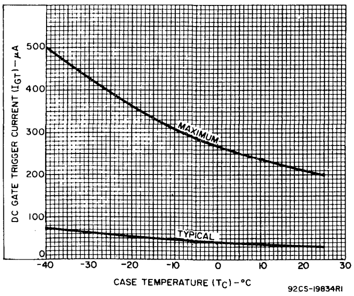


Fig. 10—DC gate-trigger current vs. case temperature for S2060 series.

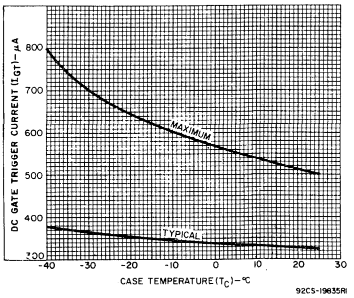


Fig. 11—DC gate-trigger current vs. case temperature for S2061 series.

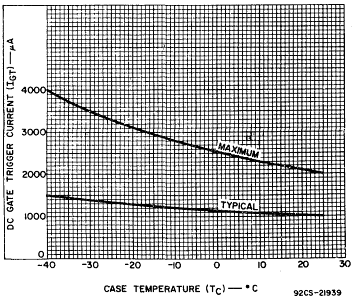


Fig. 12—DC gate-trigger current vs. case temperature for S2062 series.

S2060, S2061, S2062 Series

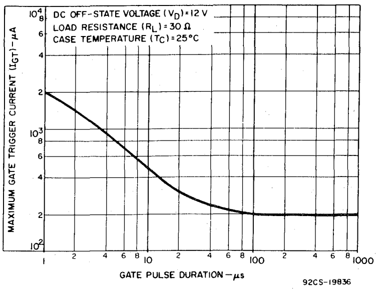


Fig. 13—Maximum gate-trigger current vs. gate-pulse duration for types in the S2060 series.

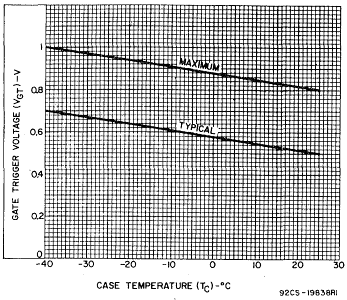


Fig. 14—Gate-trigger voltage vs. case temperature for all series.

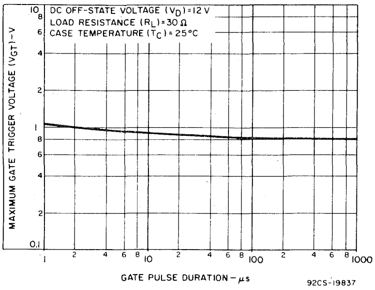


Fig. 15—Maximum gate-trigger voltage vs. gate pulse duration for types in the S2060 series.

S2200(2N3528, 2N3529,2N4102), S2710, S2700(2N3228,2N3525,2N4101, Series

5-A Silicon Controlled Rectifiers

For Low-Cost Power-Control and Power-Switching Applications

RCA 2N3228*, 2N3525*, 2N4101*, and 2N3528●, 2N3529●, and 2N4102● are all-diffused, three-junction, silicon controlled-rectifiers (SCR's) intended for use in power-control and power-switching applications.

Types 2N3228, 2N3525, and 2N4101 use the JEDEC TO-66 package and have a blocking voltage capability of up to 600 volts and a forward current rating of 5 amperes (rms value) at a case temperature of 75°C.

Types 2N3528, 2N3529, and 2N4102 use the JEDEC TO-8 package and have a blocking voltage capability of up to 600 volts and a forward current rating of 2 amperes (rms value) at an ambient temperature of 25°C.

S2710B, S2710D, and S2710M are all-diffused, three-junction silicon controlled-rectifiers having integral heat radiators. They are variants of the 2N3228, 2N3525, and 2N4101, respectively.*

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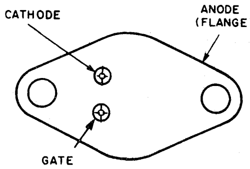
* Formerly Dev. Types TA1222, TA1225, and TA2773, respectively.

● Formerly Dev. Types TA2597, TA2617, and TA2774, respectively.

FEATURES

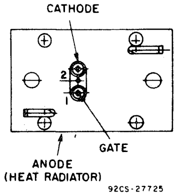
- Designed especially for high-volume systems
- Readily adaptable for printed-circuit boards and metal heat sinks
- Low switching losses
- High di/dt and dv/dt capabilities
- Shorted emitter gate-cathode construction
- Forward and reverse gate dissipation ratings
- All-diffused construction – assures exceptional uniformity and stability of characteristics
- Direct-soldered internal construction – assures exceptional resistance to fatigue
- Symmetrical gate-cathode construction – provides uniform current density, rapid electrical conduction, and efficient heat dissipation
- All-welded construction and hermetic sealing
- Low leakage currents, both forward and reverse
- Low forward voltage drop at high current levels
- Low thermal resistance

TERMINAL CONNECTIONS



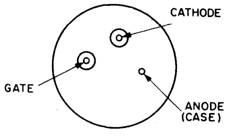
BOTTOM VIEW

JEDEC TO-66



BOTTOM VIEW

TO-66 with Heat Radiator



BOTTOM VIEW

JEDEC TO-8

Absolute-Maximum Ratings, for Operation with Sinusoidal AC Supply Voltage at a Frequency between 50 and 400 Hz, and with Resistive or Inductive Load

RATINGS	CONTROLLED-RECTIFIER TYPES						UNITS
	2N3228 S2710B	**2N3525** S2710B	**2N4101** S2710M	**2N3528**	**2N3529**	**2N4102**	
Transient Peak Reverse Voltage (Non-Repetitive), v_{RM}(non-rep)	330	660	700	330	660	700	volts
Peak Reverse Voltage (Repetitive), v_{RM}(rep)	200	400	600	200	400	600	volts
Peak Forward Blocking Voltage (Repetitive), v_{FBOM}(rep)	200	400	600	200	400	600	volts
Forward Current:							
For case temperature (T_C) of + 75°C, and unit mounted on heat sink–							
Average DC value at a conduction angle of 180°, I_{FAV}	3.2	3.2	3.2	—	—	—	amperes
RMS value, I_{FRMS}	5.0	5.0	5.0	—	—	—	amperes
For other conditions, See Fig. 2							
For free-air temperature (T_{FA}) of 25°C, and with no heat sink employed–							
Average DC value at a conduction angle of 180°, I_{FAV}	1.7	1.7	1.7	1.3	1.3	1.3	amperes
RMS value, I_{FRMS}	—	—	—	2.0	2.0	2.0	amperes
For other conditions, See *Figs.* 3 & 4							
Peak Surge Current, i_{FM}(surge):							
For one cylce of applied principal voltage.							
60 Hz (sinusoidal), T_C = 75°C		60			60		amperes
50 Hz (sinusoidal), T_C = 75°C		50			50		amperes
For more than one cycle of applied voltage.		See Fig. 5			See Fig. 5		
Fusing Current (for SCR protection): T_J = –40 to 100°C, t = 1 to 8.3 ns, I^2t		15			15		ampere^2 second
Rate of Change of Forward Current, di/dt V_{FB} = v_{BOO}(min. value) I_{GT} = 200mA, 0.5μs rise time		200			200		amperes/ microsecond
Gate Power*:							
Peak, Forward or Reverse, for 10μs duration, P_{GM} (See Figs. 7 and 9)		13			13		watts
Average, P_{GAV}		0.5			0.5		watt
Temperature:							
Storage, T_{stg}		-40 to +125			-40 to +125		°C
Operating (Case), T_C		-40 to +100			-40 to +100		°C

*Any values of peak gate current or peak gate voltage to give the maximum gate power is permissible.

S2200(2N3528, 2N3529, 2N4102), S2710, S2700(2N3228, 2N3525, 2N4101), Series

Characteristics at Maximum Ratings (unless otherwise specified), and at Indicated Case Temperature (T_C)

CHARACTERISTICS	CONTROLLED-RECTIFIER TYPES									UNITS
	2N3228, 2N3528 S2710B			2N3525, 2N3529 S2710D			2N4101, 2N4102 S2710M			
	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Forward Breakover Voltage, v_{BOO}: At T_C = +100°C	200	—	—	400	—	—	600	—	—	volts
Peak Blocking Current, at T_C = +100°C: Forward, I_{FBOM} $V_{FBO}{}^{p}$ = v_{BOO}(min. value)	—	0.10	1.5	—	0.20	3.0	—	0.40	4.0	mA
Reverse, I_{RBOM} $V_{RBO}{}^{p}$ = v_{RM}(rep) value	—	0.05	0.75	—	0.10	1.5	—	0.20	2.0	mA
Forward Voltage Drop, v_F At a Forward Current of 30 amperes and a T_C = +25°C	—	2.15	2.8	—	2.15	2.8	—	2.15	2.8	volts
DC Gate-Trigger Current, I_{GT} At T_C = +25°C (See Fig. 9)	—	8	15	—	8	15	—	8	15	mA(dc)
Gate-Trigger Voltage, V_{GT} At T_C = +25°C (See Fig. 9)	—	1.2	2.0	—	1.2	2.0	—	1.2	2.0	volts(dc)
Holding Current, i_{HOO} At T_C = +25°C	—	10	20	—	10	20	—	10	20	mA
Critical Rate of Applied Forward Voltage, Critical dv/dt V_{FB} = v_{BOO}(min. value), exponential rise, T_C = +100°C	10	200	—	10	200	—	10	200	—	volts/ microsecond
Turn-On Time, t_{on}, (Delay Time + Rise Time) V_{FB} = v_{BOO}(min. value), i_F = 4.5 amperes, I_{GT} = 200mA, 0.1 μs rise time, T_C = +25°C	0.75	1.5	—	0.75	1.5	—	0.75	1.5	—	microseconds
Turn-Off Time, t_{off}. i_F = 2 amperes, 50 μs pulse width, dv_{FB}/dt = 20 v/μs, di_r/dt = 30 A/μs, I_{GT} = 200mA, T_C = +75°C	—	15	50	—	15	50	—	15	50	microseconds

	2N3228, 2N3525, 2N4101			2N3528, 2N3529, 2N4102			
	Min.	Typ.	Max.	Min.	Typ.	Max.	
Thermal Resistance: Junction-to-case	—	—	4	—	—	5	°C/W
Junction-to-ambient	—	—	40	—	—	40	°C/W
	S2710 series			—	—	—	
Junction-to-Ambient	—	—	**28**	—	—	—	°C/W

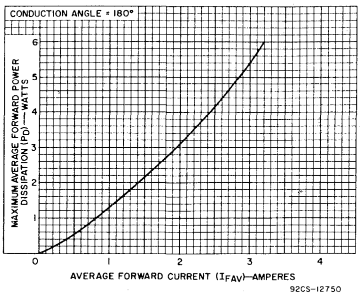


Fig. 1—Power dissipation chart for all types.

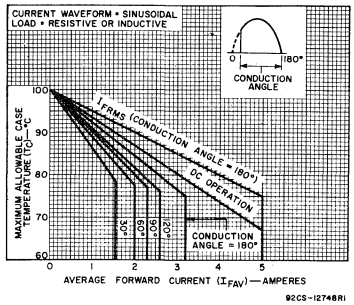


Fig. 2—Rating chart (case temperature) for types 2N3228, 2N3525, and 2N4101.

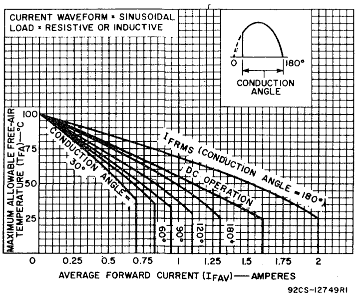


Fig. 3—Rating chart (free-air temperature) for types 2N3528, 2N3529, and 2N4102.

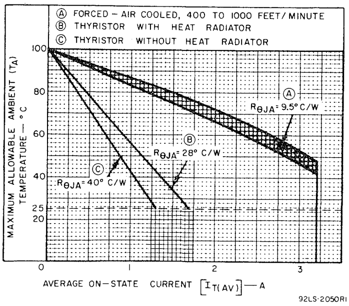


Fig. 4—Maximum allowable ambient temperature vs. on-state current for S2710 series only.

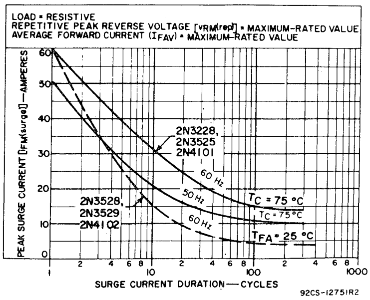


Fig. 5—Surge-current rating chart.

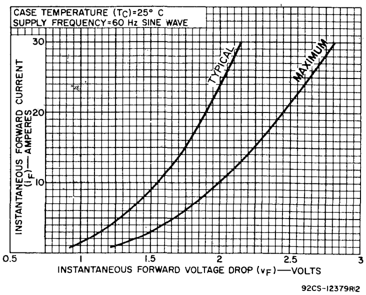


Fig. 6—Forward characteristics for all types.

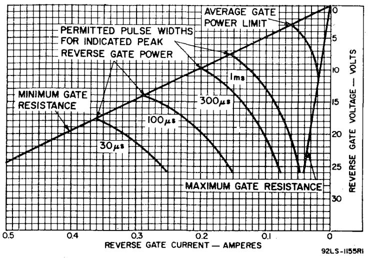


Fig. 7—Reverse gate characteristics.

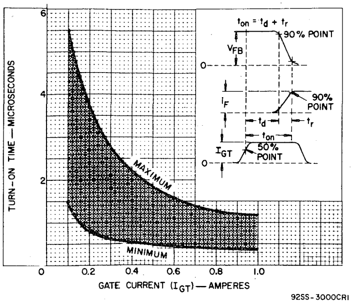


Fig. 8—Turn-on time characteristics.

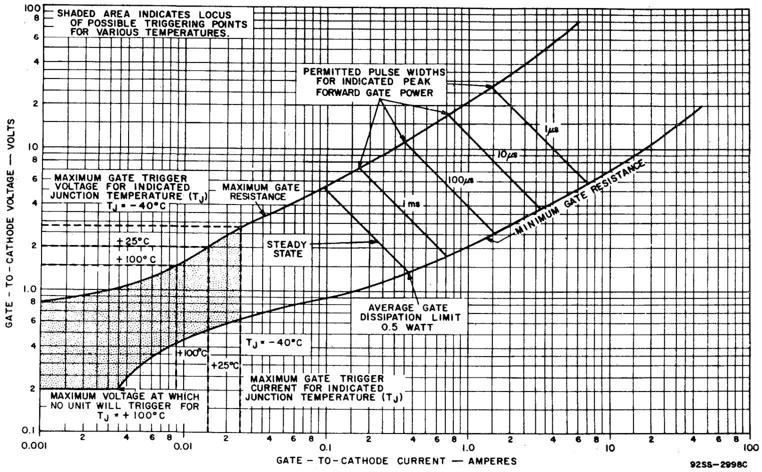


Fig. 9—Forward gate characteristics.

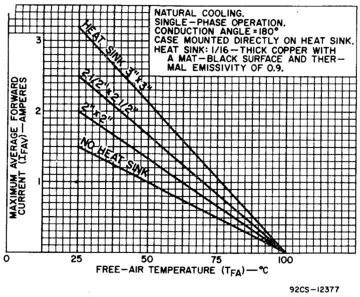


Fig. 10—Operation guidance chart for types 2N3228, 2N3525, and 2N4101.

S2600, S2610, S2620 Series

7-Ampere "Low-Profile" Silicon Controlled Rectifiers

For Power Switching, Power Control, Power Crowbar, and Ignition Applications

The S2600, S2610, and S2620 series are all-diffused, silicon controlled rectifiers (reverse-blocking triode thyristors) for capacitor-discharge ignition systems, high-voltage generators, and power-switching and control applications. They may be used in capacitor-discharge ignition systems (battery or magneto types) for internal combustion engines, electronic igniters, and high-voltage generators. Other uses are power-control and power-switching circuits.

The S2600B, S2600D, and S2600M have a three-lead low-profile package (similar to the JEDEC TO-5). The S2610B, S2610D, and S2610M have integral heat radiators. The S2620B, S2620D, and S2620M have integral heat spreaders.

Features:

- Forward and reverse gate ratings
- All-diffused center gate construction
- Low leakage currents, both forward and reverse
- Low forward voltage drop at high current levels
- High pulse-current capability for capacitor-discharge ignition circuits
- High dv/dt capability
- Low switching losses
- Low thermal resistance
- Sub-cycle surge capability curve

MAXIMUM RATINGS, *Absolute-Maximum Values:*
For Operation with Sinusoidal Supply Voltage at Frequencies up to 50/60 Hz and with Resistive or Inductive Load.

		S2600B S2610B S2620B	S2600D S2610D S2620D	S2600M S2610M S2620M	
NON-REPETITIVE PEAK REVERSE VOLTAGE●					
Gate open	V_{RSOM}	250	500	700	V
NON-REPETITIVE PEAK OFF-STATE VOLTAGE:●					
Gate open	V_{DSOM}	250	500	700	V
REPETITIVE PEAK REVERSE VOLTAGE●					
Gate open	V_{RROM}	200	400	600	V
REPETITIVE PEAK OFF-STATE VOLTAGE●					
Gate open	V_{DROM}	200	400	600	V
RMS ON-STATE CURRENT (Conduction angle = 180°)	$I_{T(RMS)}$		See Figs. 2-6		
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:	I_{TSM}				
For one cycle of applied principal voltage					
60 Hz (sinusoidal)		100	100	100	A
50 Hz (sinusoidal)		85	85	85	A
For more than one cycle of applied principal voltage			See Fig. 7		
PEAK REPETITIVE ON-STATE CURRENT† (See Fig. 16):	I_{TRM}				
Duty factor = 0.1%, T_C = 75°C Pulse duration = 5 μs (min.), 20 μs (max.)		100	100	100	A
RATE OF CHANGE OF ON-STATE CURRENT:					
$V_{DM} = V_{DROM}$, I_{GT} = 200 mA, t_r = 0.5 μs	di/dt		200		A/μs
FUSING CURRENT (for SCR protection):					
T_J = −65 to 100°C, t = 1 to 8.3 ms	I^2t		40		A^2s
NON-REPETITIVE SUB-CYCLE SURGE CURRENT:					
T_C = 25°C, single pulse, I_{GT} = 50 mA, 10 μs square pulse			See Fig. 20		
GATE POWER DISSIPATION▲:					
PEAK FORWARD (for 1 μs max.)	P_{GM}	40	40	40	W
PEAK REVERSE	P_{RGM}		See Fig. 14		
AVERAGE (averaging time = 10 ms, max.)	$P_{G(AV)}$	0.5	0.5	0.5	W
TEMPERATURE RANGE♦:					
Storage	T_{stg}		-65 to +150		°C
Operating (case)	T_C		-65 to +100		°C
LEAD TEMPERATURE (During soldering)■:					
For 10 s max. for case or leads			225		°C

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† When rms current exceeds 4 amperes (maximum rating for the anode lead), connection must be made to the case.

●These values do not apply if there is a positive gate signal. Gate must be open, terminated, or have negative bias.

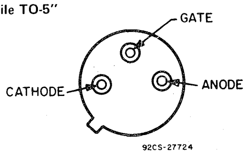
▲Any values of peak gate current or peak gate voltage that yield the maximum gate power are permissible.

♦For information on the reference point of temperature measurement, see dimensional outlines.

■When these devices are soldered directly to the heat sink, a 60/40 solder should be used. Case heating time should be a minimum . . . sufficient to allow the solder to flow freely.

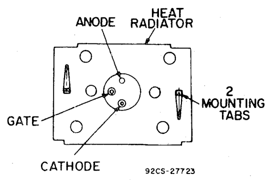
TERMINAL CONNECTIONS

"Low-Profile TO-5"



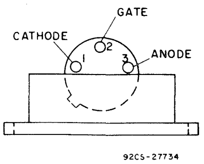
BOTTOM VIEW
S2600 Series

"Low-Profile TO-5" with Heat Radiator



BOTTOM VIEW
S2610 Series

"Low-Profile TO-5" with Heat Spreader



S2620 Series

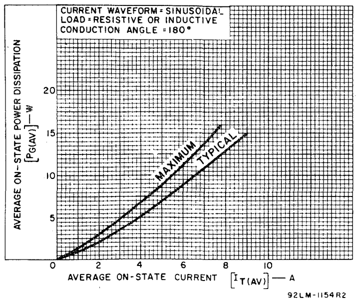


Fig. 1—Power dissipation vs. on-state current.

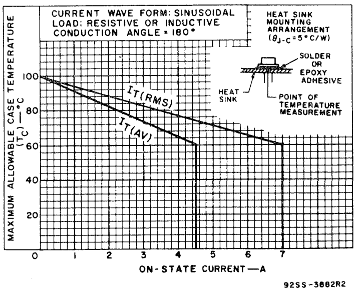


Fig. 2—Maximum allowable case temperature vs. on-state current for S2600 series.

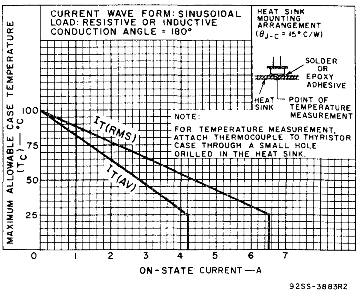
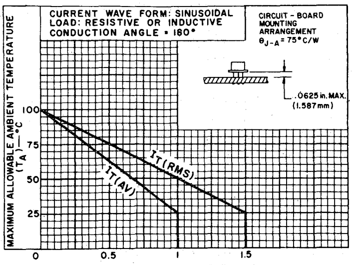


Fig. 3—Maximum allowable case temperature vs. on-state current for S2600 series.

S2600, S2610, S2620 Series

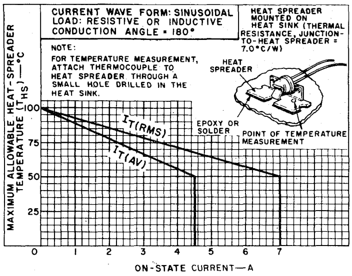
ELECTRICAL CHARACTERISTICS, *At maximum ratings and at indicated case temperature (T_C) unless otherwise specified*

CHARACTERISTIC	SYMBOL	LIMITS						UNITS
		S2600 Series			S2610 Series S2620 Series			
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
PEAK OFF-STATE CURRENT: (Gate Open, T_C = +100°C) FORWARD, $V_D = V_{DROM}$	I_{DOM}	–	0.1	0.5	–	0.2	1.5	mA
REVERSE, $V_R = V_{RROM}$	I_{ROM}	–	0.05	0.5	–	0.1	1.5	
INSTANTANEOUS ON-STATE VOLTAGE: For i_T = 30 A and T_C = +25°C	v_T	–	1.9	2.6	–	1.9	2.6	V
DC GATE TRIGGER CURRENT: V_D = 12 V (DC) R_L = 30 Ω T_C = +25°C	I_{GT}	–	6	15	–	6	15	mA
For other case temperatures		See Fig. 12						
DC GATE TRIGGER VOLTAGE: V_D = 12 V (DC) R_L = 30 Ω T_C = +25°C	V_{GT}	–	0.65	1.5	–	0.65	1.5	V
For other case temperatures		See Fig. 13						
INSTANTANEOUS HOLDING CURRENT: Gate Open and T_C = +25°C	i_{HO}	–	9	20	–	9	20	mA
For other case temperatures		See Fig. 10						
CRITICAL RATE-OF-RISE OF OFF-STATE VOLTAGE: $V_D = V_{DROM}$ Exponential rise, T_C = +100°C (See Fig. 3)	dv/dt	20	200	–	20	200	–	V/μs
GATE CONTROLLED TURN-ON TIME: $V_D = V_{DROM}$, i_T = 4.5 A I_{GT} = 200 mA, 0.1 μs rise time T_C = +25°C (See Fig. 15)	t_{gt}	–	1	2	1	2	–	μs
CIRCUIT COMMUTATED TURN-OFF TIME: $V_D = V_{DROM}$, i_T = 2 A Pulse Duration = 50 μs dv/dt = 20V/μs, di/dt = -30A/μs I_{GT} = 200 mA at turn on, T_C = +75°C	t_q	–	15	50	–	15	50	μs
THERMAL RESISTANCE: Junction-to-Case	$R_{\theta JC}$	–	–	5	–	–	5	°C/W
Junction-to-Ambient (See dimensional outlines)	$R_{\theta JA}$	–	–	120	–	–	30 (S2610 Series)	
Junction-to-Heat Spreader (See dimensional outline)	$R_{\theta JHS}$	–	–	–	–	–	7 (S2620 Series)	



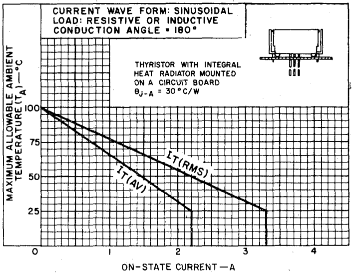
92SS-3884R2

Fig. 4—Maximum allowable ambient temperature vs. on-state current for S2600 series.



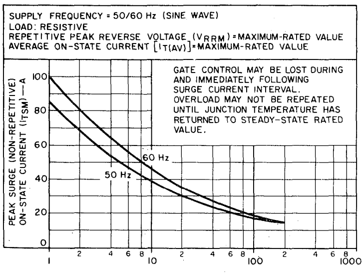
92SS-3885R2

Fig. 5—Maximum allowable heat-spreader temperature vs. on-state current for S2620 series.



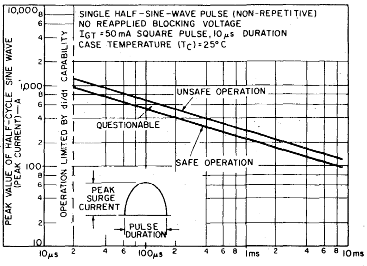
92SS-3886R2

Fig. 6—Maximum allowable ambient temperature vs. on-state current for S2610 series.



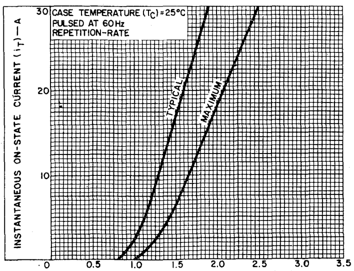
92CS-19037R1

Fig. 7—Peak surge on-state current vs. surge-current duration for all types.



92CS-19039

Fig. 8—Sub-cycle surge capability.



92LS-1150R1

Fig. 9—Instantaneous on-state current vs. on-state voltage for all types.

S2600, S2610, S2620 Series

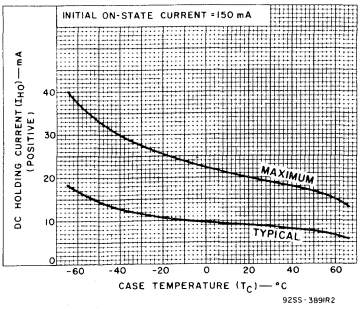


Fig. 10—DC holding current (positive) vs. case temperature.

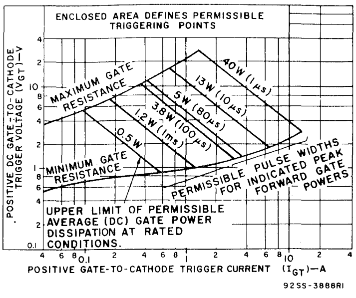


Fig. 11—Gate-pulse characteristics for forward-triggering mode.

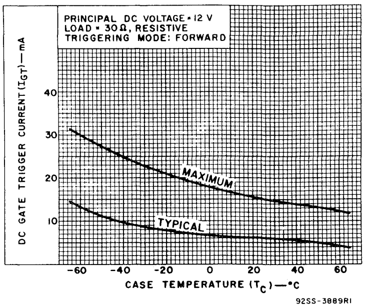


Fig. 12—DC gate-trigger current (forward) vs. case temperature.

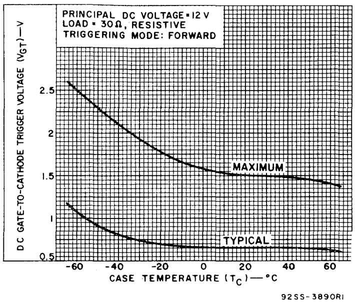


Fig. 13—DC gate-trigger voltage vs. case temperature.

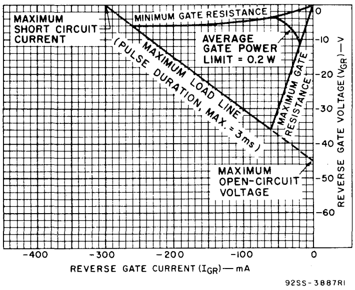


Fig. 14—Reverse-gate voltage vs. reverse-gate current.

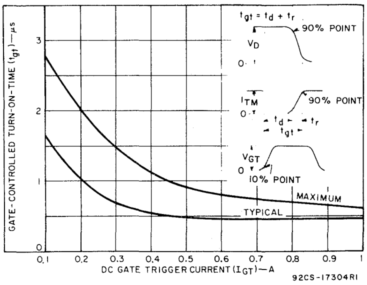


Fig. 15—Gate controlled turn-on time (t_{gt}) vs. gate-trigger current.

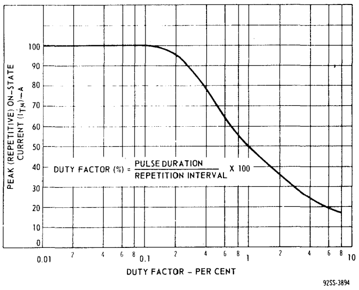


Fig. 16—Derating curve for peak pulse current (repetitive) vs. duty factor for the ignition circuit.

S122, S2800 Series

8-A and 10-A Silicon Controlled Rectifiers

For Power Switching, Power Control, and Ignition Applications

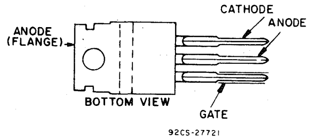
The RCA-S122 and RCA-S2800 series types are medium-power silicon controlled rectifiers (reverse-blocking triode thyristors) designed for switching ac and dc currents. These devices can switch from the off-state to the on-state when both the anode and gate voltages are positive. Negative anode voltages make these devices revert to the blocking state regardless of gate-voltage polarity.

The plastic TO-220AB package provides easy package mounting and low thermal resistance, allowing operation at high case temperatures and permitting reduced heat-sink size. These SCR's can be used in lighting and motor-speed controls, capacitor-discharge ignition circuits, high-voltage generators, automotive applications, and power-switching systems.

Features:

- High dv/dt capability
- Glass-passivated chip
- Low on-state voltage at high current levels
- Shorted-emitter gate-cathode construction
- Low thermal resistance
- Center-gate construction

TERMINAL CONNECTIONS



JEDEC TO-220AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	S122F S2800F	S122A S2800A	S122B S2800B	S122C S2800C	S122D S2800D	S122E S2800E	S122M S2800M	S122S S2800S	
V_{RSOM}▲, V_{DSOM}▲	75	125	250	375	500	600	700	800	V
V_{RROM}▲, V_{DROM}▲	50	100	200	300	400	500	600	700	V
$I_{T(RMS)}$ (T_C = 75°C,									
θ = 180°) - S122 series	8								A
- S2800 series	10								A
I_{TSM}									
For one full cycle of applied principal voltage 400 Hz	200								A
60 Hz	100								A
50 Hz	85								A
For more than one full cycle of applied principal voltage	See Fig. 4								
di/dt									
$V_D = V_{DROM}$, I_{GT} = 80 mA, t_r = 0.5 μs	100								A/μs
I^2t									
T_J = −65 to 100°C; t = 1 to 8.3 ms	40								A^2s
P_{GM}● (for 10 μs max.)	16								W
P_{RGM}●	See Fig. 10								
$P_{G(AV)}$● (averaging time = 10 ms max.)	0.5								W
T_{stg}■	−65 to +150								°C
T_C■	−65 to +100								°C
T_T									
During soldering for 10 s maximum (terminal and case)	250								°C

▲ These values do not apply if there is a positive gate signal. Gate must be open or negatively biased.

● Any values of peak gate current or peak gate voltage which result in an equal or lower power are permissible.

■ For information on the reference point of temperature measurement, see Dimensional Outline.

ELECTRICAL CHARACTERISTICS,
At Maximum Ratings Unless Otherwise Specified and at Indicated Case Temperature (T_C)

CHARACTERISTIC	LIMITS			UNITS
	For All Types Except as Specified			
	MIN.	TYP.	MAX.	
I_{DOM} or I_{ROM} $V_D = V_{DROM}$ or $V_R = V_{RROM}$, T_C = +100°C	–	0.1	2	mA
V_T See Fig. 5 & 6 i_T = 16 A, T_C = 25°C (S122 series)	–	1.45	1.83	V
= 30 A, T_C = 25°C (S2800 series)	–	1.7	2	
I_{GT} See Fig. 11 & 12 V_D = 12 V (dc), R_L = 30 Ω, T_C = 25°C (S122 series)	–	18	25	mA
V_D = 12 V (dc), R_L = 30 Ω, T_C = 25°C (S2800 series)	–	8	15	
V_{GT} V_D = 12 V (dc), R_L = 30 Ω, T_C = 25°C	–	0.9	1.5	V
For other case temperatures		See Fig. 13		
I_{HO} T_C = 25°C (S122 series)	–	20	30	mA
T_C = 25°C (S2800 series)	–	10	20	
For other case temperatures		See Fig. 7 & 8		

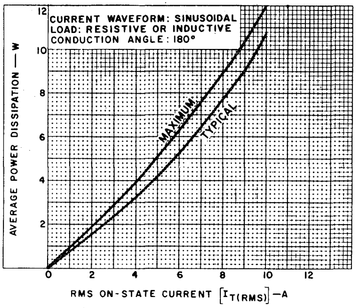


Fig. 1 — Power dissipation vs. on-state current for all types.

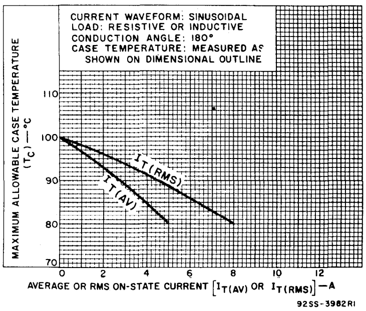


Fig. 2 — Maximum allowable case temperature vs. on-state current for S122 series.

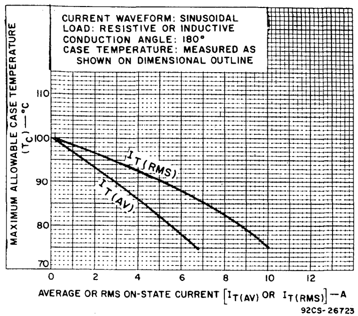


Fig. 3 — Maximum allowable case temperature vs. on-state current for S2800 series.

S122 , S2800 Series

ELECTRICAL CHARACTERISTICS,

At Maximum Ratings Unless Otherwise Specified and at Indicated Case Temperature (T_C)

CHARACTERISTIC	LIMITS			UNITS
	For All Types Except as Specified			
	MIN.	TYP.	MAX.	
dv/dt $V_D = V_{DROM}$ Exponential voltage rise, $T_C = 100°C$ S122 series	10	100	–	V/µs
S2800F	100	–	–	
S2800A	75	–	–	
S2800B	50	–	–	
S2800C	40	–	–	
S2800D	30	–	–	
S2800E	25	–	–	
S2800M	20	–	–	
S2800S	15	–	–	
t_{gt} See Fig. 16 $V_D = V_{DROM}$, i_T = 4.5 A, i_T = 2 A I_{GT} = 80 mA, 0.1 µs rise time T_C = +25°C	–	1.6	2.5	µs
t_q $V_D = V_{DROM}$, i_T = 2 A, t_p = 50 µs dv/dt = 200 V/µs, di/dt = –10 A/µs I_{GT} = 200 mA at t_{ON}, T_C = +75°C	–	10	35	µs
$R_{\theta JC}$	–	–	2	°C/W
$R_{\theta JA}$	–	–	60	

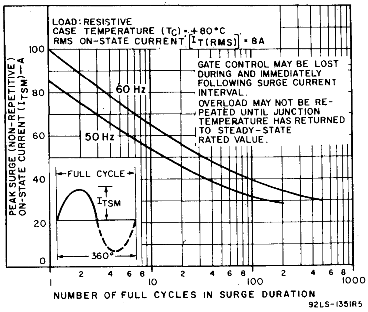


Fig. 4 — Allowable peak surge on-state current vs. surge duration for all types.

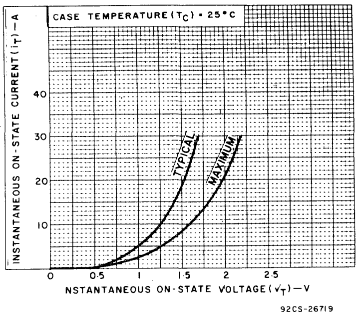


Fig. 5 — Instantaneous on-state current vs.on-state voltage for S122 series.

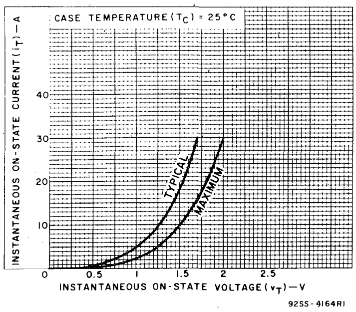


Fig. 6 — Instantaneous on-state current vs. on-state voltage for S2800 series.

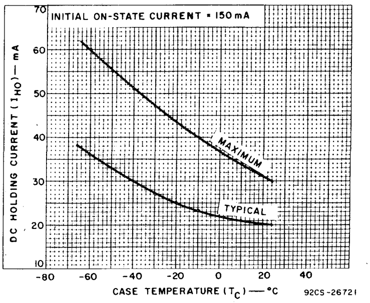


Fig. 7 — Holding current vs. case temperature for S122 series.

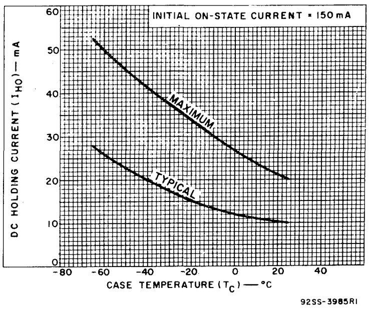


Fig. 8 — Holding current vs. case temperature for S2800 series.

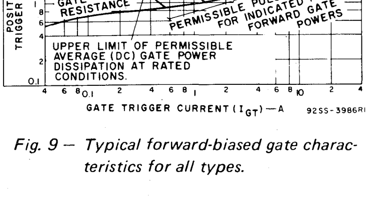


Fig. 9 — Typical forward-biased gate characteristics for all types.

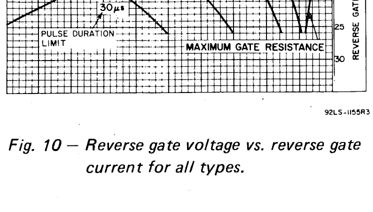


Fig. 10 — Reverse gate voltage vs. reverse gate current for all types.

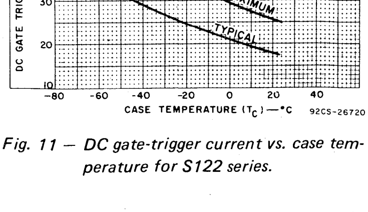


Fig. 11 — DC gate-trigger current vs. case temperature for S122 series.

S122, S2800 Series

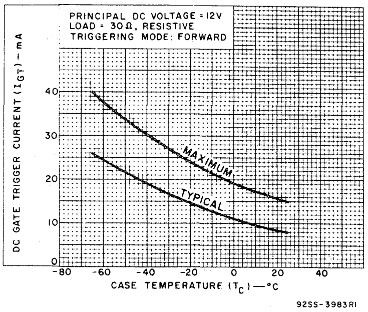


Fig. 12 – DC gate-trigger current vs. case temperature for S2800 series.

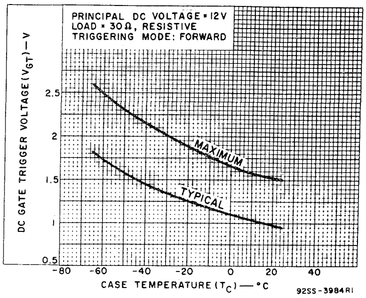


Fig. 13 – DC gate-trigger voltage vs. case temperature for all types.

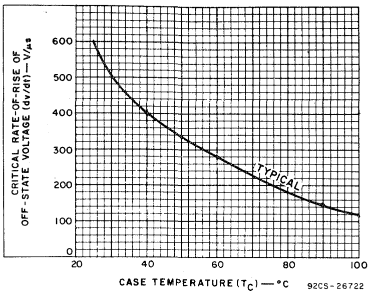


Fig. 14 – Critical rate-of-rise of off-state voltage vs. case temperature for S122 series.

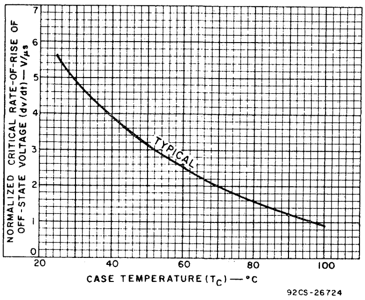


Fig. 15 – Normalized critical rate of rise of off-state voltage vs. case temperature for S2800 series.

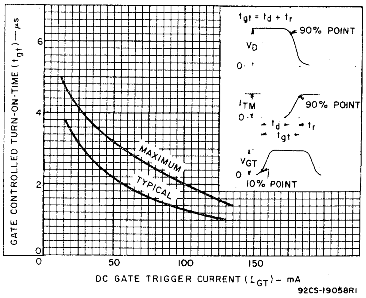


Fig. 16 – Gate-controlled turn-on time vs. gate trigger current for all types.

S3700, S3704, S3714 Series

5-A Silicon Controlled Rectifiers

For Inverter Applications

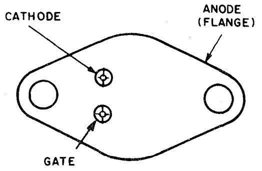
The RCA-S3700, S3704, and S3714-series types are all-diffused, silicon controlled rectifiers (reverse-blocking triode thyristors) designed for inverter applications such as ultrasonics, choppers, regulated power supplies, induction heaters, cycloconverters, and fluorescent lighting. These types may be used at frequencies up to 25 kHz.

The S3700 and S3704 series employ a hermetic JEDEC TO-66 package. The S3714 series employs a TO-66 with heat radiator package.

Features

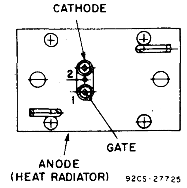
- **Fast turn-off time-8 μs max.**
- **High di/dt and dv/dt capabilities**
- **Shorted-emitter gate-cathode construction . . .contains an internally diffused resistor between gate and cathode**
- **Center gate construction. . . .provides rapid uniform gate-current spreading for faster turn-on with substantially reduced heating effects**

TERMINAL CONNECTIONS



BOTTOM VIEW

JEDEC TO-66



BOTTOM VIEW

JEDEC TO-66 with Heat Radiator

MAXIMUM RATINGS, *Absolute-Maximum Values:*

			S3700B	S3700D	S3700M		
		S3704A S3714A	S3704B S3714B	S3704D S3714D	S3704M S3714M	S3704S S3714S	
NON-REPETITIVE PEAK REVERSE VOLTAGE:■ Gate Open	V_{RSOM}	150	300	500	700	800	V
NON-REPETITIVE PEAK OFF-STATE VOLTAGE:■ Gate Open	V_{DSOM}	150	300	500	700	800	V
REPETITIVE PEAK REVERSE VOLTAGE:■ Gate Open	V_{RROM}	100	200	400	600	700	V
REPETITIVE PEAK OFF-STATE VOLTAGE:■ Gate Open	V_{DROM}	100	200	400	600	700	V
ON-STATE CURRENT: $T_C = 60°C$, conduction angle = 180°:							
RMS	$I_{T(RMS)}$	5					A
Average	$I_{T(AV)}$	3.2					A
For other conditions		See Figs. 3, 4					
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:	I_{TSM}						
For one full cycle of applied principal voltage, $T_C = 60°C$							
60 Hz (sinusoidal)		80					A
50 Hz (sinusoidal)		65					A
For more than one full cycle of applied principal voltage		See Fig. 5					
RATE OF CHANGE OF ON-STATE CURRENT $V_D = V_{DROM}$, $I_{GT} = 50$ mA, $t_r = 0.1$ μs	di/dt	200					A/μs
FUSING CURRENT (for SCR protection): $T_J = -40$ to 100°C, t = 1 to 8.3 ms	I^2t	25					A
GATE POWER DISSIPATION:●							
Peak Forward (for 10 μs max., See Fig. 7)	P_{GM}	13					W
Peak Reverse (for 10 μs max., See Fig. 8)	P_{RGM}	13					W
Average (averaging time = 10 ms max.)	$P_{G(AV)}$	0.5					W
TEMPERATURE RANGE:▲							
Storage	T_{stg}	−40 to 150					°C
Operating (Case)	T_C	−40 to 100					°C
PIN TEMPERATURE (During soldering): At distances ⩾ 1/32 in. (0.8 mm) from seating plane for 10 s max.	T_P	225					°C

■ These values do not apply if there is a positive gate signal. Gate must be open or negatively biased.

● Any product of gate current and gate voltage which results in a gate power less than the maximum is permitted.

▲ For temperature measurement reference point, *see Dimensional Outline.*

ELECTRICAL CHARACTERISTICS

At Maximum Ratings Unless Otherwise Specified and at Indicated Case Temperature (T_C)

CHARACTERISTIC	SYMBOL	LIMITS FOR ALL TYPES Except as Specified			UNITS
		MIN.	TYP.	MAX.	
Peak Off-State Current: (Gate open, $T_C = 100°C$)					
Forward Current (I_{DOM}) at $V_D = V_{DROM}$	I_{DOM}	–	0.5	3	mA
Reverse Current (I_{ROM}) at $V_R = V_{RROM}$	I_{ROM}	–	0.3	1.5	
Instantaneous On-State Voltage: $i_T = 30$ A (peak), $T_C = 25°C$	v_T	–	2.2	3	V
For other conditions			See Fig. 6		
Instantaneous Holding Current: Gate open, $T_C = 25°C$	i_{HO}	–	20	50	mA
Critical Rate of Rise of Off-State Voltage: $V_D = V_{DROM}$, exponential voltage rise, Gate open, $T_C = 80°C$	dv/dt	100	250	–	V/μs
DC Gate Trigger Current: $V_D = 12$ V (dc), $R_L = 30\ \Omega$, $T_C = 25°C$	I_{GT}	–	15	40	mA
For other conditions			See Fig. 7		
DC Gate Trigger Voltage: $V_D = 12$ V (dc), $R_L = 30\ \Omega$, $T_C = 25°C$	V_{GT}	–	1.8	3.5	V
For other conditions			See Fig. 7		
Gate Controlled Turn-On Time: (Delay Time + Rise Time) For $V_{DX} = V_{DROM}$, $I_{GT} = 300$ mA, $t_r = 0.1$ μs, $I_T = 2$ A (peak), $T_C = 25°C$ (See Fig. 10)	t_{gt}	–	0.7	–	μs
Circuit Commutated Turn-Off Time: $V_{DX} = V_{DROM}$, $i_T = 2$ A, pulse duration = 50 μs, dv/dt = 100 V/μs, −di/dt = −10 A/μs, $I_{GT} = 100$ mA, $V_{GT} = 0$ V (at turn-off), $T_C = 80°C$ (See Fig. 13)	t_q				μs
S3700 series		–	4	6	
S3704, S3714 series		–	4	8	
Thermal Resistance:					
Junction-to-Case	$R_{\theta JC}$	–	4	8	°C/W
Junction-to-Ambient	$R_{\theta JA}$	–	–	40	°C/W

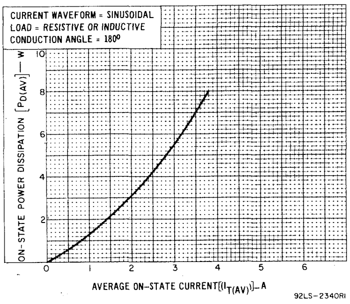


Fig. 1—Power dissipation vs. average on-state current.

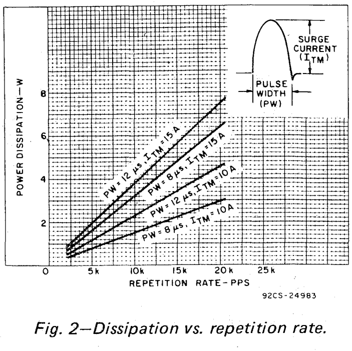
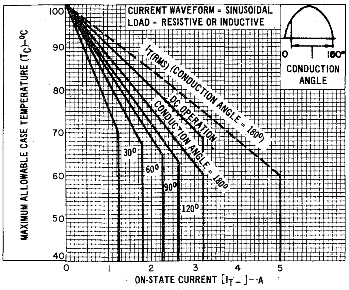


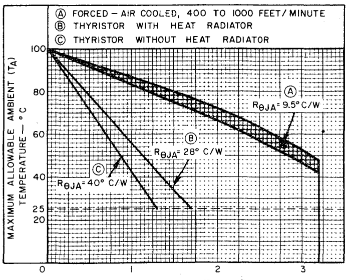
Fig. 2—Dissipation vs. repetition rate.

S3700, S3704, S3714 Series



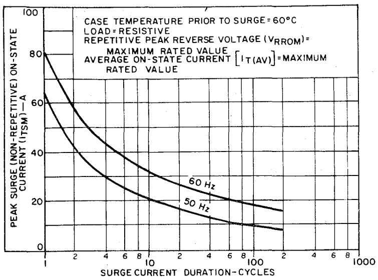
92LS-2342R1

Fig. 3—Maximum allowable case temperature vs. on-state current.



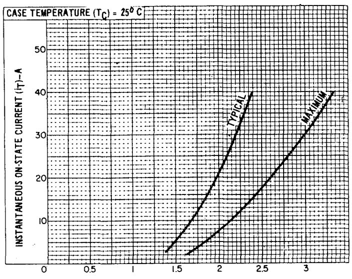
92LS-2050R1

Fig. 4—Maximum allowable ambient temperature vs. average on-state current.



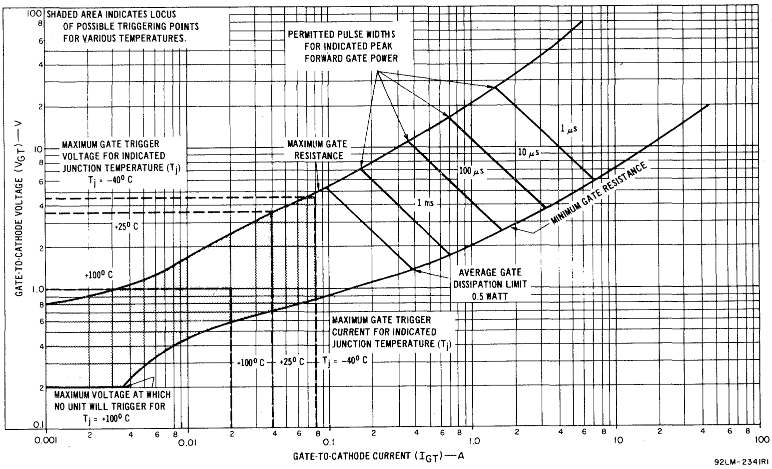
92LS-1149R2

Fig. 5—Peak surge on-state current vs. surge-current duration.



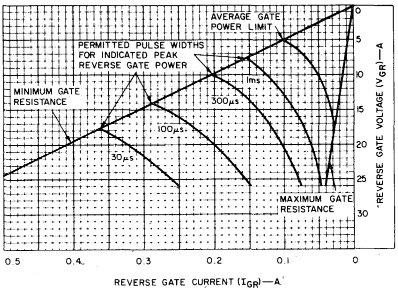
92LS-2344R1

Fig. 6—Instantaneous on-state current vs. on-state voltage.



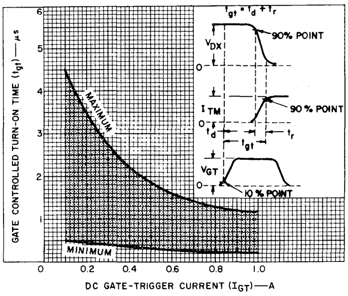
92LM-2341R1

Fig. 7—Gate-trigger characteristics and limiting conditions for determination of permissible gate-trigger pulses.



92LS-2351R1

Fig. 8—Reverse-gate voltage vs. reverse-gate current.



92LS-2350R2

Fig. 9—Turn-on time vs. gate-trigger current.

S3701M

5-Ampere Silicon Controlled Rectifier

For Applications in Pulse Power Supplies To Drive GaAs Laser Diodes

Type S3701M is a silicon controlled rectifier intended for use in circuits which generate pulses to drive injection laser diodes.

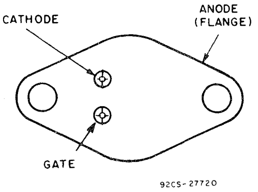
The S3701M SCR is designed for the good current-spreading and delay-time characteristics necessary to provide high-peak-current pulses to drive the laser diode. An additional significant characteristic of this device is its well controlled holding current, which assures operation only at currents sufficiently high to meet the circuit requirements.

The S3701M SCR employs a hermetic JEDEC TO-66 package.

Features:

- **High peak-current capability**
- **Good current-spreading attributes**
- **Symmetrical gate-cathode construction for uniform current density, rapid electrical conduction, and efficient heat dissipation**
- **Controlled minimum holding current**
- **Hermetic construction**
- **Low thermal resistance**

TERMINAL CONNECTIONS



BOTTOM VIEW

JEDEC TO-66

MAXIMUM RATINGS, *Absolute-Maximum Values:*
Case temperature (T_C) = 25°C, unless otherwise specified

REPETITIVE PEAK OFF-STATE VOLTAGE:			
Gate open	V_{DROM}	600	V
RMS ON-STATE CURRENT (Conduction angle = 180°)	$I_{T(RMS)}$	5	A
REPETITIVE PEAK ON-STATE CURRENT (0.2 μs Pulse Width):	I_{PM}		
Free-air cooling, f = 500 Hz		75	A
Free-air cooling, f = 5000 Hz		40	A
Infinite heat sink, f = 10,000 Hz		40	A
Infinite heat sink, f = 1,000 Hz		75	A
GATE POWER DISSIPATION:			
PEAK (For 10 μs pulse)	P_{GM}	25	W
TEMPERATURE RANGE:			
Storage	T_{stg}	-40 to 125°C	
Operating (Case)	T_C	-40 to 100°C	
TERMINAL TEMPERATURE (During soldering):	T_T		
For 10 s max. (terminals and case)		225	°C

ELECTRICAL CHARACTERISTICS
At Maximum Ratings and at Indicated Case Temperature (T_C) Unless Otherwise Specified

CHARACTERISTIC	SYMBOL	LIMITS		UNITS
		Min.	Max.	
Peak Off-State Current: Gate open, v_D = V_{DROM}, T_C = 25°C T_C = 75°C	I_{DROM}	– –	0.65 1.2	mA
DC Gate-Trigger Current: T_C = 25°C	I_{GT}	–	35	mA
DC Gate-Trigger Voltage: T_C = 25°C	V_{GT}	–	4	V
DC Holding Current: Gate open, T_C = 25°C T_C = 75°C	I_{HO}	15 10	– –	mA
Critical Rate-of-Rise of Off-State Voltage: For v_D = V_{DROM}, exponential voltage rise, gate open, T_C = 75°C	dv/dt	200	–	V/μs
Source Voltage for Functional Test (See Fig. 2): I_p = 75A, C = 0.022μF, R_s = 2Ω, f = 60Hz, pulse duration = 0.2μs, T_C = 25°C	V_s	–	550	V
Thermal Resistance: Junction-to-Case Junction-to-Ambient	$R_{\theta JC}$ $R_{\theta JA}$	– –	7 40	°C/W

S3702S, S3703SF, D2101S, D2103S, D2103SF, S3705M, S3706E, D2600M, D2601E, D2601M

SCR's and Rectifiers for Horizontal-Deflection Circuits

For Large-Screen Color TV

The RCA SCR's S3702S, S3702SF, S3705M, and S3706E and the RCA rectifiers D2101S, D2103S D2103SF, D2600M, D2601E, and D2601M are designed for use in horizontal output circuits.

The S3703SF silicon controlled rectifier and the D2102SF silicon rectifier are designed to act as a bipolar switch that controls horizontal yoke current during the beam trace interval. The S3702S silicon controlled rectifier and the D2103S silicon rectifier act as the commutating switch to initiate trace-retrace switching and control yoke current during retrace.

The D2101S silicon rectifier may be used as a clamp to protect the circuit components from excessively high transient voltages which may be generated as a result of arcing in the picture tube or in a high-voltage rectifier tube.

To facilitate direct connection across each silicon controlled rectifier, S3702S and S3702SF, the anode connections of silicon rectifiers D2103S and D2103SF are reversed as compared to that of a normal power-supply rectifier diode.

The S3705M silicon controlled rectifier and the D2601M silicon rectifier are designed to act as a bipolar switch that controls horizontal yoke current during the beam trace interval. The S3706E silicon controlled rectifier and the D2601E silicon rectifier act as the commutating switch to initiate trace-retrace switching and control yoke current during retrace.

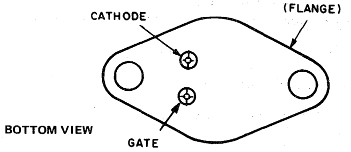
The D2600M silicon rectifier may be used as a clamp to protect the circuit components from excessively high transient voltages which may be generated as a result of arcing in the picture tube or in a high-voltage rectifier tube.

The SCR's employ a hermetic JEDEC TO-66 package. The rectifier types D2101S D2103S, and D2103SF employ a hermetic JEDEC TO-1 package. The rectifier types D2600M, D2601E, and D2601M employ a hermetic JEDEC DO-26 package.

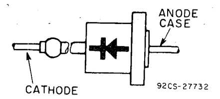
Features:

- **Operation from supply voltages between 150 and 270 V (nominal)**
- **Ability to handle high beam current; average 1.6 mA dc**
- **Ability to supply as much as 5 mJ to 8 mJ of stored energy to the deflection yoke, which is sufficient for 29-mm-neck picture tubes operated at 29 kV or 31 kV (nominal value)**
- **Highly reliable circuit which can also be used as a low-voltage power supply**

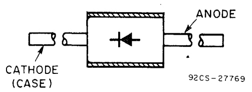
TERMINAL DESIGNATIONS



JEDEC TO-3



JEDEC DO-1



JEDEC DO-26

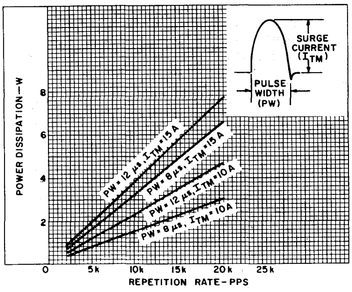


Fig. 1 — Dissipation vs. repetition rate for S3702S and S3702SF.

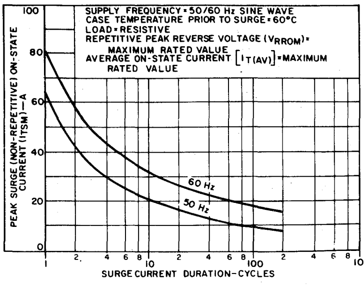


Fig. 2 — Peak surge on-state current vs. surge current duration for S3705M and S3706E.

SILICON CONTROLLED RECTIFIERS
MAXIMUM RATINGS, *Absolute-Maximum Values:*

		S3703SF	S3705M	S3702S	S3706E	
		TRACE SCR		COMMUTATING SCR		
NON-REPETITIVE PEAK OFF-STATE VOLTAGE:●						
Gate Open	V_{DSOM}	800*	700*	750*	600*	V
REPETITIVE PEAK REVERSE VOLTAGE:●						
Gate Open	V_{RROM}	25	25	25	25	V
REPETITIVE PEAK OFF-STATE VOLTAGE:●						
Gate Open	V_{DROM}	750	600	700	500	V
ON-STATE CURRENT						
T_C = 60°C, 60 Hz sine wave, conduction angle = 180°:						
RMS	$I_{T(RMS)}$	5	5	5	5	A
Average DC	$I_{T(AV)}$	3.2	3.2	3.2	3.2	A
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:	I_{TSM}					
For one full cycle of applied principal voltage						
60 Hz (sinusoidal), T_C = 60°C		80	80	80	80	A
50 Hz (sinusoidal), T_C = 60°C		65	65	65	65	A
For one-half sine wave, 3 ms pulse width		130	150	130	150	A
RATE OF CHANGE OF ON-STATE CURRENT:						
$V_D = V_{DROM}$, I_{GT} = 50 mA, t_r = 0.1 μs	di/dt	200				A/μs
FUSING CURRENT (for SCR protection):						
T_J = −40 to 80°C, t = 1 to 10 ms	I^2t	20				A^2s
GATE POWER DISSIPATION:■	P_{GM}					
Peak (forward or reverse) for 10 μs duration, max.						
negative gate bias = −35 V (S3703SF, S3705M)		25				W
= −10 V (S3702S, S3706E)		25				W
TEMPERATURE RANGE:▲						
Storage	T_{stg}	−40 to 150				°C
Operating (Case)	T_C	−40 to 80				°C
PIN TEMPERATURE (During soldering)						
At distances ⩾ 1/32 in. (0.8 mm) from seating plane for 10 s max.	T_P	225				°C

---

* Protection against transients above these values induced by arcing or other causes must be provided.

● These values do not apply if there is a positive gate signal, Gate must be open or negatively biased.

■ Any product of gate current and gate voltage which results in a gate power less than the maximum is permitted, provided that the maximum *reverse gate bias (as specified) is not exceeded.*

▲ For temperature measurement reference point, see Dimension Outline.

S3702S, S3703SF, D2101S, D2103S, D2103SF, S3705M, S3706E, D2600M, D2601E, D2601M

SILICON CONTROLLED RECTIFIERS

ELECTRICAL CHARACTERISTICS, *At Maximum Ratings Unless Otherwise Specified and at Indicated Case Temperature (T_C)*

CHARACTERISTIC	SYMBOL	LIMITS				UNITS
		S3703SF S3705M TRACE SCR.		S3702S S3706E COMMUT. SCR		
		TYP.	MAX.	TYP.	MAX.	
Peak Forward Off-State Current: Gate open, $V_D = V_{DROM}$, T_C = 85°C	I_{DOM}	0.5	1.5	0.5	1.5	mA
Instantaneous On-State Voltage: i_T = 30 A (peak), T_C = 25°C	v_T	2.2	3	2.2	3	V
Critical Rate-of-Rise of Off-State Voltage: $V_D = V_{DROM}$, exponential voltage rise, Gate open, T_C = 70°C S3702S	dv/dt	–	–	700 (min.) $(dv/dt)_3$		V/µs
S3706E		175 (min.)		1000 (min.) $(dv/dt)_2$		
DC Gate Trigger Current: V_D = 12 V (dc), R_L = 30 Ω, T_C = 25°C	I_{GT}	15	32	15	45	mA
DC Gate Trigger Voltage: V_D = 12 V (dc), R_L = 30Ω, T_C = 25°C	V_{GT}	1.8	4	1.8	4	V
Circuit Commutated Turn-Off Time: ◆ T_C = 70°C, minimum negative gate bias during turn-off time = –20 V (S3703SF, S3705M) and –2.5 V (S3702S, S3706E), rate of reapplied voltage (dv/dt) = 175 V/µs S3703S	t_q	–	2.4	–	–	µs
S3705M		–	2.5	–	–	
= 400 V/µs S3702S		–	–	–	4.2	
S3706E		–	–	–	4.5	
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	–	4	–	4	°C/W

◆ This parameter, the sum of reverse recovery time and gate recovery time, is measured from the zero crossing of current to the start of the reapplied voltage. Knowledge of the current, the reapplied voltage, and the case temperature is necessary when measuring t_q. In the worst conditions (high line, zero-beam, off-frequency, minimum auxiliary load, etc.) turn-off time must not fall below the given values. Turn-off time increases with temperature; therefore, case temperature must not exceed 70°C,

SILICON RECTIFIERS

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		D2103SF	D2601M	D2103S	D2601E	D2101S	D2600M	
		TRACE		COMMUTATING		CLAMP		
REVERSE VOLTAGE:**								
Repetitive Peak	V_{RRM}	750	600	700	500	700	600	V
Non-Repetitive Peak●●	V_{RSM}	800	700	800	600	800	700	V
FORWARD CURRENT (operating in 15 kHz deflection circuit):								
RMS	$I_{F(RMS)}$	3■■	1.9■■	3■■	1.6■■	1**	0.5**	A
Peak Surge (Non-Repetitive)●●	I_{FSM}	70◆◆	70◆◆	70◆◆	70◆◆	30◆◆	30◆◆	A
Peak (Repetitive)	I_{FRM}	7	6.5	12	6	0.5	0.5	A
TEMPERATURE RANGE								
Storage	T_{stg}	–30 to 150						°C
Operating (Case)	T_C	–30 to 80						°C
LEAD TEMPERATURE (During Soldering):▲▲								
For 10 s maximum	T_L	225						°C

** For ambient temperatures up to 45°C.

●● For a maximum of 3 pulses, each less than 10 µs duration, during any 64 µs period.

■■ Maximum current rating applies only if the rectifier is properly mounted to maintain junction temperature below 150°C.

◆◆ See Figs. 4 & 5 for I_{FSM} value for 60 Hz.

▲▲ At distances no closer to rectifier body than points A and B on outline drawing.

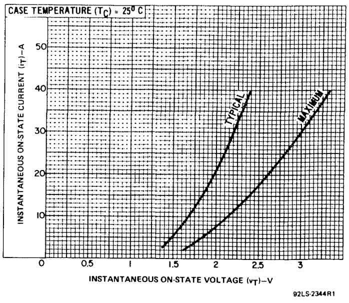


Fig. 3 — Instantaneous on-state current vs. on-state voltage for S3702S and S3703SF.

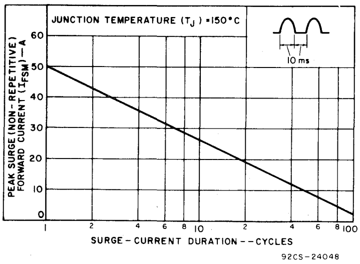


Fig. 4 — Peak surge (non-repetitive) forward current vs. surge-current duration for D2101S, D2103S, and D2103SF.

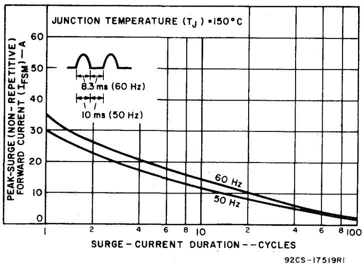


Fig. 5 — Peak-surge (non-repetitive) forward current vs. surge-current duration for D2600M, D2601E, and D2601M.

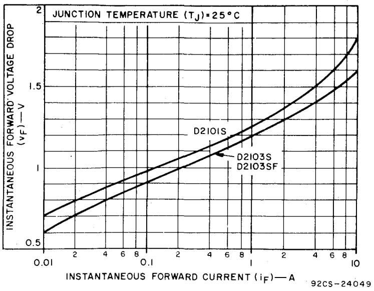


Fig. 6 — Forward-voltage drop vs. forward current for D2101S, D2103S, and D2103SF.

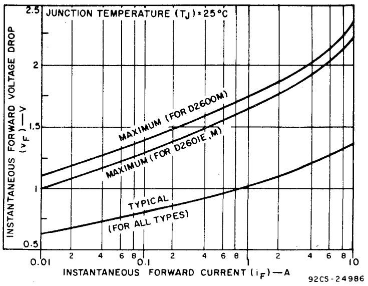


Fig. 7 — Forward-voltage drop vs. forward current for D2600M, D2601E, and D2601M.

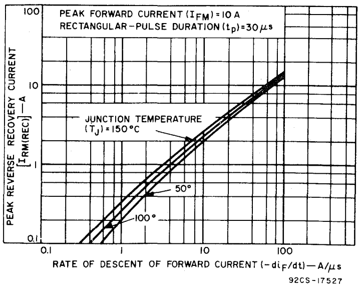


Fig. 8 — Typical peak reverse-recovery current vs. rate of descent of forward current for all rectifiers.

S3702S, S3703SF, D2101S, D2103S, D2103SF, S3705M, S3706E, D2600M, D2601E, D2601M

SILICON RECTIFIERS

ELECTRICAL CHARACTERISTICS,

CHARACTERISTIC	SYMBOL	LIMITS		UNITS
		D2103SF D2601M TRACE D2103S D2601E COMMUT.	D2101S D2600M CLAMP	
		MAXIMUM	MINIMUM	
Reverse Current: *Static* For V_{RRM} = max. rated value, I_F = 0, T_C = 25°C . . . . For V_R = 500 V, T_C = 100°C.	I_{RM}	10 250	10 250	μA
Instantaneous Forward Voltage Drop: At i_F = 4 A, T_A = 25°C (See Fig. 6, 7)	v_F	1.4 (D2103SF, D2103S)	1.5 (D2101S)	V
		1.9 (D2601M, D2601E)	2 (D2600M)	
Reverse Recovery Time: At I_{FM} = 3.14 A, $-di_F/dt$ = −10 A/μs, pulse duration = 0.94 μs, T_C = 25°C	t_{rr}	0.5 (D2103SF, D2103S)	0.7 (D2101S)	μs
At I_{FM} = 20 A, $-di_F/dt$ = −20 A/μs, pulse duration = 2.8 μs, T_C = 25°C		0.5 (D2601M, D2601E)	0.7 (D2600M)	
In Tektronix type "S" plug-in unit (or equivalent): At I_F = 20 mA, I_R = 1 mA, T_C = 25°C		1.2	1.5	
Peak Forward Voltage Drop (at turn-on): In Tektronic type "S" plug-in unit (or equivalent): At I_F = 20 mA, T_C = 25°C	$V_{F(pk)}$	5	6	V
Thermal Resistance (Junction-to-Case)▲	$R_{\theta JC}$	10 (D2103SF, D2103S)	10 (D2101S)	°C/W
Thermal Resistance (Junction-to-Lead)▲ (See Fig. 11)	$R_{\theta JL}$	45 (D2601M, D2601E)	45 (D2600M)	

▲ Measured at point as indicated on Dimensional Outline.

◆ Measured on anode lead 1/8 in. (3.18 mm) from case.

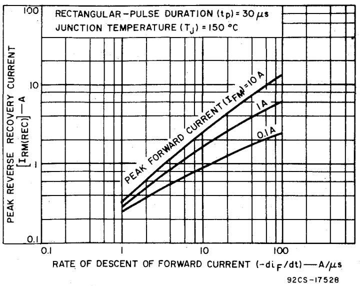


Fig. 9 — Typical peak reverse-recovery current vs. rate of descent of forward-current for all rectifiers.

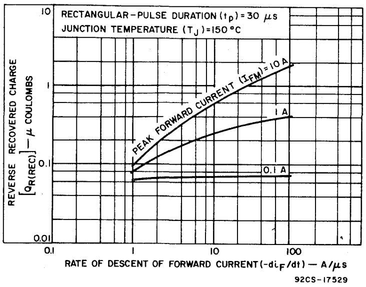


Fig. 10 — Typical reverse-recovered charge vs. rate of descent of forward current for all rectifiers.

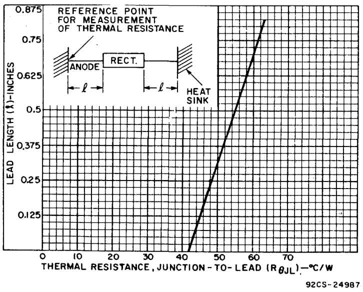


Fig. 11 — Junction-to-lead thermal resistance vs. lead length for D2600M, D2601E, and D2601M.

S3900, S3901, S3902DF, S3903MF Series

Monolithic Integrated Thyristor/Rectifiers (ITR's) for TV Horizontal-Deflection Circuits

Color and Monochrome

The RCA-S3900- and S3901-series and the S3902DF and S3903MF integrated thyristor/rectifiers are all-diffused power monolithic circuits that incorporate a silicon controlled rectifier and a silicon rectifier on a common pellet. The S3900-series and S3902DF types are used as bipolar switches to control horizontal yoke current during the beam trace interval; the S3901-series and S3903MF types are used as commutating switches to initiate trace-retrace switching.

The S3900 and S3901-series ITR's are designed for use in color TV circuits. Devices in the S3900 series are capable of supplying 8 mJ of stored energy to the deflection yoke; this is sufficient for 29-mm-neck and 35-mm-neck color picture tubes operated at a nominal value of 31 kV.

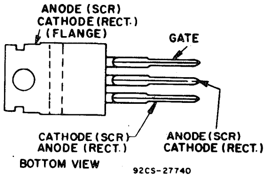
The S3902DF and S3903MF types are intended for use in black-and-white TV circuits. The S3903DF ITR is capable of supplying 3 mJ of stored energy to the deflection yoke; this is sufficient for 29-mm-neck monochrome tubes operated at 19 kV nominal value.

All types in these four series are supplied in the JEDEC TO-220AB package. The plastic used in this package is a flame-retardant material.

Features:

- Operation from nominal supply voltages between:
  - 100 V and 240 V – S3902DF, S3903MF
  - 140 V and 270 V – S3900, S3901 Series
- Ability to handle high beam current:
  - 1 mA dc (avg.) – S3902DF, S3903MF
  - 1.6 mA dc (avg.) – S3900, S3901 Series
- Ability to supply stored energy to the deflection yoke, as much as:
  - 3 mJ for 19 kV (nom.) monochrome tubes – S3902DF
  - 8 mJ for 31 kV (nom.) color TV tubes – S3900 Series
- Highly reliable circuit which can also be used as a low-voltage power supply

TERMINAL CONNECTIONS



JEDEC TO-220AB

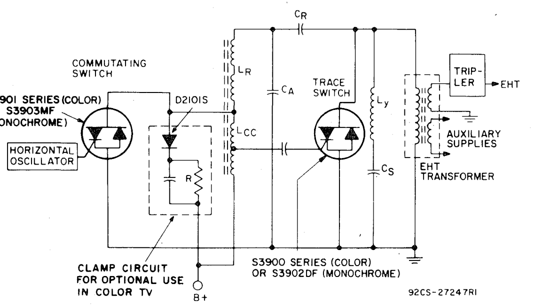


Fig. 1 – Simplified schematic diagram of horizontal output circuit.

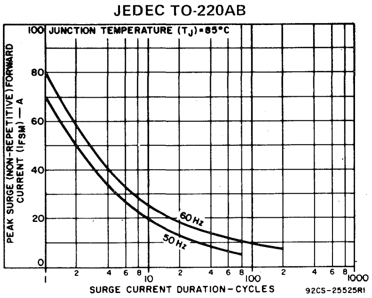


Fig. 2 – Peak surge forward current vs. surge-current duration for rectifier unit of ITR (all types).

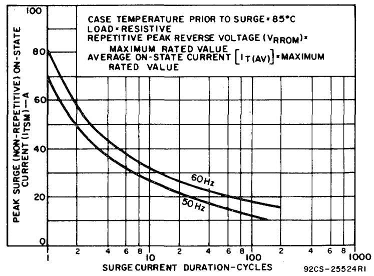


Fig. 3 – Peak surge on-state current vs. surge-current duration for SCR unit of ITR (all types).

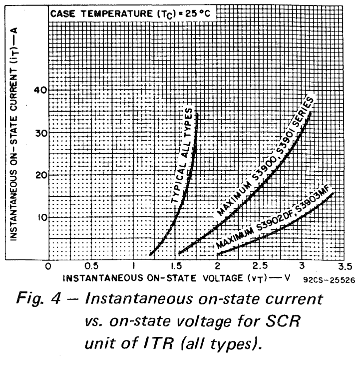


Fig. 4 – Instantaneous on-state current vs. on-state voltage for SCR unit of ITR (all types).

ITR's FOR COLOR TELEVISION

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	TRACE				COMMUTATING			
	S3900E	S3900MF	S3900S	S3900SF	S3901M	S3901MF	S3901S	
V_{DSOM}:* ● $T_C = 85^oC$	550	700	750	800	650	700	750	V
V_{RROM}: ● $T_C = 85^oC$	4	4	4	4	4	4	4	V
V_{DROM}: ● $T_C = 85^oC$	500	650	700	750	600	650	700	V
CURRENT:								
$T_C = 60^oC$, 50 Hz sine wave, $\theta = 180^o$:								
Rectifier Unit:								
I_o	3							A
$I_{F(RMS)}$	4.5							A
SCR Unit:								
$I_{T(AV)}$	5							A
$I_{T(RMS)}$	8							A
I_{TSM}:								
For one full cycle of applied principal voltage:								
60 Hz (sinusoidal), T_C=85°C:								
Rectifier Unit, I_{FSM}	80							A
SCR Unit, I_{TSM}	80							A
50 Hz (sinusoidal), T_C=85°C:								
Rectifier Unit, I_{FSM}	70							A
SCR Unit, I_{TSM}	70							A
For more than one full cycle of applied principal voltage	See Figs. 6 and 7							
For one-half sine wave, t_p=3 ms:								
Rectifier Unit, I_{FSM}	150							A
SCR Unit, I_{TSM}	150							A

S3900, S3901, S3902DF, S3903MF Series

ITR's FOR COLOR TELEVISION

MAXIMUM RATINGS, *Absolute-Maximum Values:* **(Cont'd)**

	TRACE			COMMUTATING			
	S3900MF	S3900S	S3900SF	S3901M	S3901MF	S3901S	
di/dt: $V_D = V_{DROM}$, $I_{GT} = 50$ mA, $t_r = 0.1$ µs	200						A/µs
I^2t (For ITR protection): $T_J = -40$ to 85°C, t = 1 to 10 ms	30						A^2s
P_{GM}:■ Forward or reverse for 10 µs duration, max. negative gate bias = −10 V	25						W
T_{stg}:▲	−40 to 150						°C
T_C:▲	−40 to 85						°C
T_T (During soldering): At distances ⩾ 1/8 in. (3.17 mm) from case for 10 s max.	225						°C

*Protection against transients above these values induced by arcing or other causes must be provided.

●These values do not apply if there is a positive gate signal. Gate must be open or negatively biased.

■Any product of gate current and gate voltage which results in a gate power less than the maximum is permitted, provided that the maximum reverse gate bias (as specified) is not exceeded.

▲For temperature measurement reference point, see Dimensional Outline.

ELECTRICAL CHARACTERISTICS FOR ITR's FOR COLOR-TELEVISION CIRCUITS

At Maximum Ratings and at Case Temperature (T_C) = 25°C Unless Otherwise Specified

CHARACTERISTIC	LIMITS				UNITS
	S3900 Series TRACE ITR		S3901 Series COMMUTATING ITR		
	TYP.	MAX.	TYP.	MAX.	
I_{DOM}: $V_D = V_{DROM}$, $T_C = 85$°C	0.5	1.5	0.5	1.5	mA
V_T: SCR Unit: $i_T = 30$ A (See Fig. 4)	1.75	3	1.75	3	V
V_F: Rectifier Unit: $i_F = 10$ A (See Fig. 5)	1.35	1.7	1.35	2	V
dv/dt: $V_D = V_{DROM}$, $T_C = 85$°C $V_G = -2.5$ V min. (S3901 Series)	175 (min.)		1000 (min.) $(dv/dt)_2$		V/µs
I_{GT}: $V_D = 12$ V dc, $R_L = 30$ Ω	15	40	15	45	mA
V_{GT}: $V_D = 12$ V dc, $R_L = 30$ Ω	1.8	4	1.8	4	V
t_q: ◆ $T_C = 80$°C Minimum negative gate bias = −20 V (S3900 Series) = −2.5 V (S3901 Series) dv/dt = 175 V/µs (S3900 Series)	–	2.4	–	–	µs
dv/dt = 400 V/µs (S3901 Series)	–	–	–	4.2	

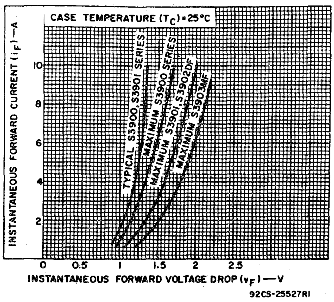


Fig. 5 – Instantaneous forward current vs. forward voltage drop for rectifier unit of ITR (all types).

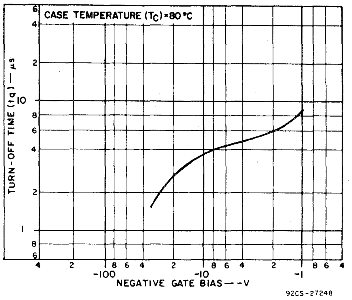


Fig. 6 – Typical turn-off time vs. gate bias for S3900-series types.

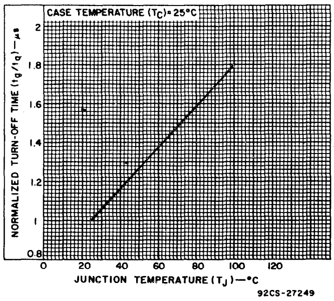


Fig. 7 – Normalized turn-off time vs. junction temperature for S3900- and S3901-series types.

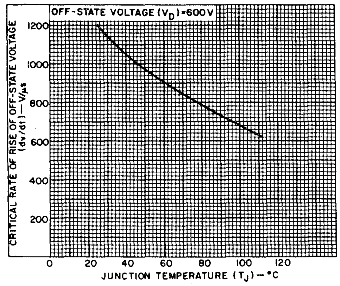


Fig. 8 – Typical dv/dt vs. junction temperature for S3900- and S3901-series types.

S3900, S3901, S3902DF, S3903MF Series

ELECTRICAL CHARACTERISTICS FOR ITR's FOR COLOR-TELEVISION CIRCUITS (Cont'd)
At Maximum Ratings and at Case Temperature (T_C) = 25°C Unless Otherwise Specified

CHARACTERISTIC	LIMITS				UNITS
	S3900 Series TRACE ITR		S3901 Series COMMUTATING ITR		
	TYP.	MAX.	TYP.	MAX.	
t_{rr}: Rectifier Unit: I_{FM} = 10 A, $-di_F/dt = -10$ A/μs, t_p = 3 μs	0.5	0.7	0.5	0.7	μs
V_{FM} (At t_g): Rectifier Unit: I_{FM} = 1 A	8	13	–	–	V
$R_{\theta JC}$ ▲	–	2.5	–	2.5	°C/W

◆ Turn-off time increases with temperature; therefore, case temperature must not exceed the level indicated.

▲ Measured at point indicated on Dimensional Outline.

ITR's FOR MONOCHROME TELEVISION

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	TRACE S3902DF	COMMUTATING S3903MF	
V_{DSOM}: * ● T_C = 85°C	500	700	V
V_{RROM}: ● T_C = 85°C	4	4	V
V_{DROM}: ● T_C = 85°C	450	650	V
CURRENT: T_C = 60°C, 50 Hz sine wave, θ = 180°: Rectifier Unit:			
I_o	3		A
$I_{F(RMS)}$	4.5		A
SCR Unit: $I_{T(AV)}$	5		A
$I_{T(RMS)}$	8		A
I_{TSM}: For one full cycle of applied principal voltage: 60 Hz (sinusoidal), T_C = 85°C: Rectifier Unit, I_{FSM}	80		A
SCR Unit, I_{TSM}	80		A
50 Hz (sinusoidal), T_C = 85°C: Rectifier Unit, I_{FSM}	70		A
SCR Unit, I_{TSM}	70		A
For more than one full cycle of applied principal voltage	See Figs. 2 and 3		
For one-half sine wave, t_p = 3 ms: Rectifier Unit, I_{FSM}	150		A
SCR Unit, I_{TSM}	150		A
di/dt: $V_D = V_{DROM}$, I_{GT} = 50 mA, t_r = 0.1 μs	200		A/μs
I^2t (For ITR protection): T_J = –40 to 85°C, t = 1 to 10 ms	30		A^2s
P_{GM}: ■ Forward or reverse for 10 μs duration, max. negative gate bias = –10 V	25		W
T_{stg}: ▲	–40 to 150		°C
T_C: ▲	–40 to 85		°C
T_T (During soldering): At distances ⩾ 1/8 in. (3.17 mm) from case for 10 s max.	225		°C

---

*Protection against transients above these values induced by arcing or other causes must be provided.

●These values do not apply if there is a positive gate signal. Gate must be open or negatively biased.

■Any product of gate current and gate voltage which results in a gate power less than the maximum is permitted, provided that the maximum reverse gate bias (as specified) is not exceeded.

▲For temperature measurement reference point, see Dimensional Outline.

ELECTRICAL CHARACTERISTICS FOR ITR's FOR MONOCHROME-TELEVISION CIRCUITS
At Maximum Ratings and at Case Temperature (T_C) = 25°C Unless Otherwise Specified

CHARACTERISTIC	LIMITS				UNITS
	S3902DF TRACE ITR		S3903MF COMMUTATING ITR		
	TYP.	MAX.	TYP.	MAX.	
I_{DOM}: $V_D = V_{DROM}$, T_C = 85°C	0.5	1.5	0.5	1.5	mA
v_T: SCR Unit: i_T = 10 A (See Fig. 4)	1.75	3	1.75	3	V
v_F: Rectifier Unit: i_F = 4 A (See Fig. 5)	1.35	1.6	1.35	1.8	V
dv/dt: $V_D = V_{DROM}$, T_C = 85°C V_G = –2.5 V min. (S3903MF)	120 (min.)		700 (min.) $(dv/dt)_2$		V/μs
I_{GT}: V_D = 12 V dc, R_L = 30 Ω	15	40	15	45	mA
V_{GT}: V_D = 12 V dc, R_L = 30 Ω	1.8	4	1.8	4	V
t_q: ◆ T_C = 80°C Minimum negative gate bias = –20 V (S3902DF) = –2.5 V (S3903MF) dv/dt = 120 V/μs (S3902DF)	–	3	–	–	μs
dv/dt = 400 V/μs (S3903 Series)	–	–	–	5	μs
t_{rr}: Rectifier Unit: I_{FM} = 3.14 A, $-di_F/dt = -10$ A/μs, t_p = 0.94 μs	0.3	0.5	0.3	0.5	μs
V_{FM} (At t_g): Rectifier Unit: I_{FM} = 1 A	8	13	–	–	V
$R_{\theta JC}$ ▲	–	2.5	–	2.5	°C/W

◆ Turn-off time increases with temperature; therefore, case temperature must not exceed the level indicated.

▲ Measured at point indicated on Dimensional Outline.

S4000(2N3668-2N3670,2N4103) Series

12.5-A Silicon Controlled Rectifiers

For Low-Cost Power-Control and Power-Switching Applications

RCA 2N3668*, 2N3669*, 2N3670*, and 2N4103* are all-diffused, three-junction, silicon controlled-rectifiers (SCR's). They are intended for use in power-control and power-switching applications requiring a blocking voltage capability of up to 600 volts and a forward-current capability of 12.5 amperes (rms value) or 8 amperes (average value) at a case temperature of 80°C.

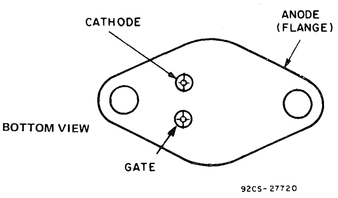
The 2N3668 is designed for low-voltage power supplies, the 2N3669 for direct operation from 120-volt line supplies, the 2N3670 for direct operation from 240-volt line supplies, and the 2N4103 for high-voltage power supplies.

The 2N3668, 2N3669, 2N3670 and 2N4103 SCR's employ the hermetic JEDEC TO-3 package.

Features:

- Low switching losses
- High di/dt and dv/dt capabilities
- Shorted emitter gate-cathode construction
- Forward and reverse gate dissipation ratings
- Designed especially for high-volume systems
- All-diffused construction – assures exceptional uniformity and stability of characteristics
- Direct-soldered internal construction – assures exceptional resistance to fatigue
- Symmetrical gate-cathode construction – provides uniform current density, rapid electrical conduction, and efficient heat dissipation
- All-welded construction and hermetic sealing
- Low leakage currents, both forward and reverse
- Low forward voltage drop at high current levels
- Low thermal resistance

TERMINAL DESIGNATIONS



JEDEC TO-3

Absolute-Maximum Ratings, for Operation with Sinusoidal AC Supply Voltage at a Frequency between 50 and 400 Hz, and with Resistive or Inductive Load

RATINGS	CONTROLLED-RECTIFIER TYPES				UNITS
	2N3668	2N3669	2N3670	2N4103	
Transient Peak Reverse Voltage (Non-Repetitive), v_{RM}(non-rep)	150	330	660	700	volts
Peak Reverse Voltage (Repetitive), v_{RM}(rep)	100	200	400	600	volts
Peak Forward Blocking Voltage (Repetitive), v_{FBOM}(rep)	100	200	400	600	volts
Forward Current:					
For case temperature (T_C) of +80° C					
Average DC value at a conduction angle of 180°, I_{FAV}	8	8	8	8	amperes
RMS value, I_{FRMS}	12.5	12.5	12.5	12.5	amperes
For other conditions, (See Fig. 4)					
Peak Surge Current, i_{FM}(surge):					
For one cycle of applied voltage	200	200	200	200	amperes
For one cycle of applied principal voltage					
60 Hz (sinusoidal), T_C = 80°C	200	200	200	200	amperes
50 Hz (sinusoidal), T_C = 80°C	170	170	170	170	amperes
For more than one cycle of applied voltage	See Fig. 2	See Fig. 2	See Fig. 2	See Fig. 2	
Fusing Current (for SCR protection):					
T_J = –40 to 100°C, t = 1 to 8.3 ms, I^2t	170	170	170	170	ampere^2 second
Rate of Change of Forward Current, di/dt V_{FB} = v_{BOO}(min. value) I_{GT} = 200mA, 0.5 μs rise time	200	200	200	200	amperes/ microsecond
Gate Power*:					
Peak, Forward or Reverse, for 10 μs duration, P_{GM} (See Figs. 5 and 6)	40	40	40	40	watts
Average, P_{GAV}	0.5	0.5	0.5	0.5	watt
Temperature:					
Storage, T_{stg}●	-40 to +125	-40 to +125	-40 to +125	-40 to +125	°C
Operating (Case), T_C	-40 to +100	-40 to +100	-40 to +100	-40 to +10G	°C

* Any values of peak gate current or peak gate voltage to give the maximum gate power is permissible.

● Temperature reference point is within 1/8 in. (3.17 mm) of the center of the underside of unit.

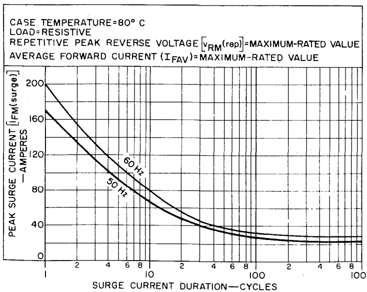


Fig. 1 – Peak surge current vs. surge current duration.

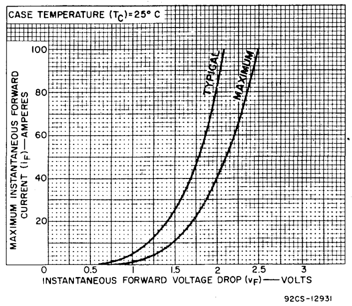


Fig. 2 – Instantaneous forward current vs. instantaneous forward voltage drop.

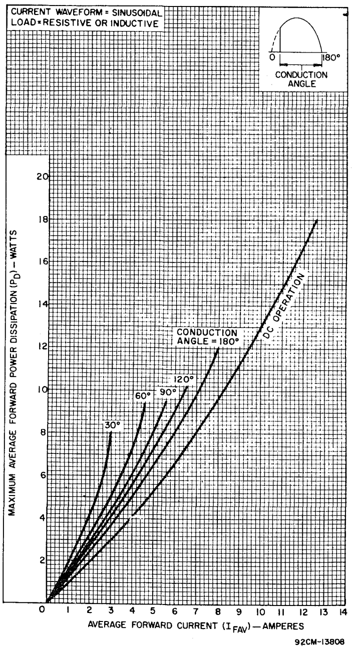


Fig. 3 – Power dissipation vs. forward current.

*Formerly Dev. Types TA2621, TA2598, TA2618, and TA2775, respectively.

S4000(2N3668-2N3670,2N4103) Series

ELECTRICAL CHARACTERISTICS

Characteristics at Maximum Ratings (unless otherwise specified), and at Indicated Case Temperature (T_C)

CHARACTERISTICS	CONTROLLED-RECTIFIER TYPES												UNITS
	2N3668			2N3669			2N3670			2N4103			
	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Peak Repetitive Blocking Voltage, V_{DROM} At T_C = +100°C	100	—	—	200	—	—	400	—	—	600	—	—	volts
Peak Blocking Current, at T_C = +100°C: Forward, I_{DOM} $V_D = V_{DROM}$	—	0.2	2	—	0.25	2.5	—	0.3	3	—	0.35	4	mA
Reverse, I_{ROM} $V_R = V_{RROM}$	—	0.05	1	—	0.1	1.25	—	0.2	1.5	—	0.3	3	mA
Forward Voltage Drop, v_F At a Forward Current of 25 amperes and a T_C = +25°C (See Fig. 2)	—	1.5	1.8	—	1.5	1.8	—	1.5	1.8	—	1.5	1.8	volts
DC Gate-Trigger Current, I_{GT}: At T_C = +25°C (See Fig. 5)	1	20	40	1	20	40	1	20	40	1	20	40	mA(dc)
Gate-Trigger Voltage, V_{GT}: At T_C = +25°C (See Fig. 5)	—	1.5	2	—	1.5	2	—	1.5	2	—	1.5	2	volts (dc)
Holding Current, i_{HOO}: At T_C = +25°C	0.5	25	50	0.5	25	50	0.5	25	50	0.5	25	50	mA
Critical Rate of Applied Forward Voltage, Critical dv/dt $V_{FB} = v_{BOO}$(min.value), exponential rise, T_C = +100°C	10	100	—	10	100	—	10	100	—	10	100	—	volts/ microsecond
Turn-On Time, t_{on}, (Delay Time + Rise Time) $V_{FB} = v_{BOO}$(min. value), i_F = 8 amperes, I_{GT} = 200mA, 0.1 μs rise time, T_C = +25°C (See waveshapes of Fig. 3)	0.75	1.25	—	0.75	1.25	—	0.75	1.25	—	0.75	1.25	—	microseconds
Turn-Off Time, t_{off}, (Reverse Recovery Time + Gate Recovery Time) i_F = 8 amperes, 50 μs pulse width, dv_{FB}/dt = 20 v/μs, di_r/dt = 30 A/μs, I_{GT} = 200mA, T_C = +80°C	—	20	50	—	20	50	—	20	50	—	20	50	microseconds
Thermal Resistance, Junction-to-Case	—	—	1.7	—	—	1.7	—	—	1.7	—	—	1.7	°C/W

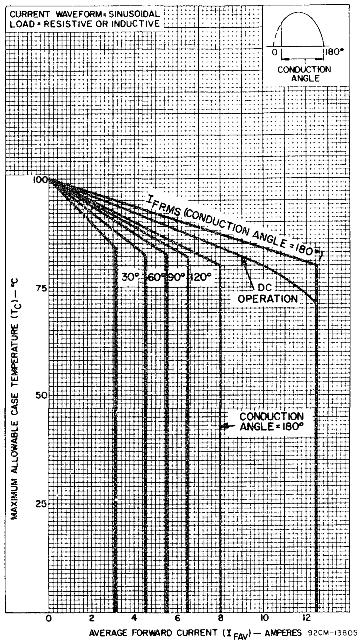


Fig. 4 — Maximum allowable case temperature vs. average forward current.

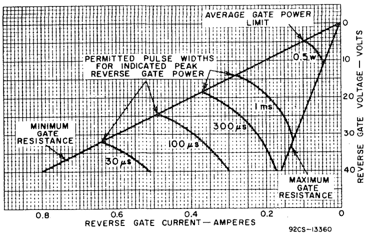


Fig. 6 — Reverse gate characteristics.

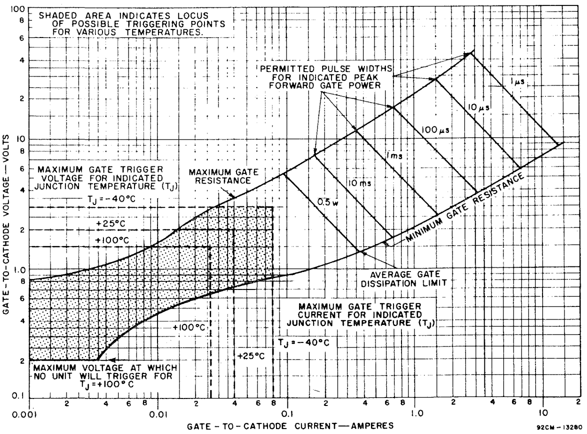


Fig. 5 — Forward gate characteristics.

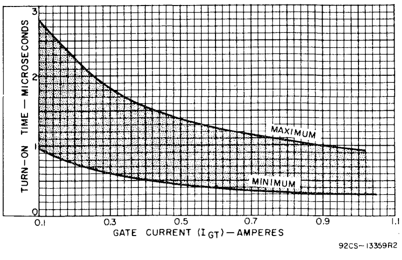


Fig. 7 — Turn-on time vs. gate current.

S4000(2N3668-2N3670, 2N4103) Series

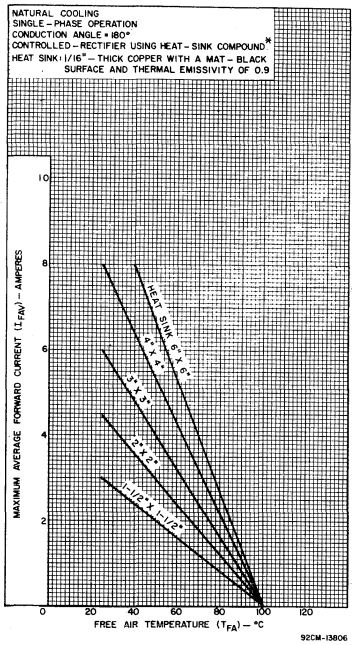


Fig. 8 — Natural-cooling operation guidance chart.

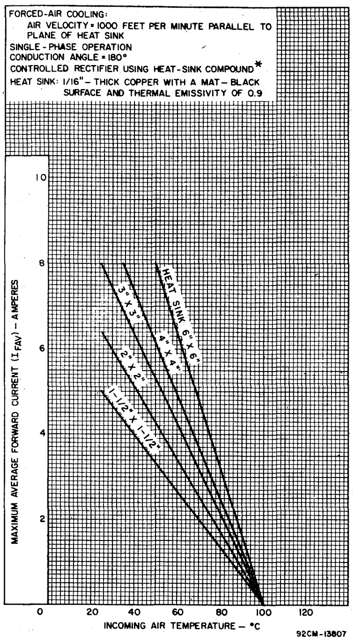


Fig. 9 — Forced-air cooling operation guidance chart.

*Dow Corning 340 Silicon Heat Sink Compound, or Equivalent.

S5210 Series

10-A Silicon Controlled Rectifiers

For Inverter Applications

RCA-S5210-series types are all-diffused, silicon controlled rectifiers designed for high-frequency power-switching applications such as inverters, switching regulators, and high-current pulse applications. These types may be used at frequencies up to 25 kHz.

Features:

- **Fast turn-off time — 8 μs max.**
- ***High di/dt and dv/dt capabilities***
- **Shorted-emitter gate-cathode construction . . . contains an internally diffused resistor between gate and cathode**
- **Low thermal resistance**
- **Center gate construction . . . provides rapid uniform gate-current spreading for faster turn-on with substantially reduced heating effects**

MAXIMUM RATINGS, *Absolute-Maximum Values:*

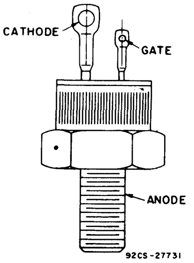
		S5210B	S5210D	S5210M	
NON-REPETITIVE PEAK REVERSE VOLTAGE:[●]					
Gate Open	V_{RSOM}	200	400	600	V
NON-REPETITIVE PEAK OFF-STATE VOLTAGE:[●]					
Gate Open	V_{DSOM}	250	500	700	V
REPETITIVE PEAK REVERSE VOLTAGE:[●]					
Gate Open	V_{RROM}	200	400	600	V
REPETITIVE PEAK OFF-STATE VOLTAGE:[●]					
Gate Open	V_{DROM}	200	400	600	V
ON-STATE CURRENT:					
T_C = 85°C, conduction angle = 180°:					
RMS	$I_{T(RMS)}$		← 10 →		A
Average	$I_{T(AV)}$		← 6.3 →		A
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:					
For one full cycle of applied principal voltage 60 Hz (sinusoidal)	I_{TSM}		← 90 →		A
RATE OF CHANGE OF ON-STATE CURRENT:					
$V_D = V_{DROM}$, I_{GT} = 50 mA, t_r = 0.1 μs	di/dt		← 200 →		A/μs
FUSING CURRENT (for SCR protection):					
T_J = −40 to 100°C, t = 1 to 8.3 ms	I^2t		← 35 →		A^2s
GATE POWER DISSIPATION:[■]					
Peak Forward (for 10 μs max.)	P_{GM}		← 13 →		W
Average (averaging time = 10 ms max.)	$P_{G(AV)}$		← 0.5 →		W
TEMPERATURE RANGE:[▲]					
Storage	T_{stg}		← −40 to 150 →		°C
Operating (Case)	T_C		← −40 to 100 →		°C
TERMINAL TEMPERATURE ***(During Soldering):***					
For 10 s max. (terminals and case)	T_T		← 225 →		°C
STUD TORQUE:	τ_s				
Recommended			← 35 →		in-lb
Maximum (DO NOT EXCEED)			← 50 →		in-lb

[●] These values do not apply if there is a positive gate signal. Gate must be open or negatively biased.

[■] Any product of gate current and gate voltage which results in a gate power less than the maximum is permitted.

[▲] For temperature measurement reference point, see Dimensional Outline.

TERMINAL DESIGNATIONS



1/4 — 28-Thread Stud Package

ELECTRICAL CHARACTERISTICS

At Maximum Ratings Unless Otherwise Specified and at Indicated Case Temperature (T_C)

CHARACTERISTIC	SYMBOL	LIMITS FOR ALL TYPES Except as Specified			UNITS
		Min.	Typ.	Max.	
Peak Off-State Current: (Gate open, T_C = 100°C) Forward Current (I_{DOM}) at $V_D = V_{DROM}$	I_{DOM}	–	–	3	mA
Reverse Current (I_{ROM}) at $V_R = V_{RROM}$	I_{ROM}	–	–	3	
Instantaneous On-State Voltage: i_T = 30 A (peak), T_C = 25°C	v_T	–	2.2	3	V
For other conditions			(See Fig.3)		
Instantaneous Holding Current: Gate open, T_C = 25°C	i_{HO}	–	20	50	mA
Critical Rate of Rise of Off-State Voltage $V_D = V_{DROM}$, exponential voltage rise, Gate open, T_C = 80°C	dv/dt	100	250	–	V/μs
DC Gate Trigger Current: V_D = 12 V (dc), R_L = 30 Ω, T_C = 25°C	I_{GT}	–	15	40	mA
DC Gate Trigger Voltage: V_D = 12 V (dc), R_L = 30 Ω, T_C = 25°C	V_{GT}	–	1.8	3.5	V
Gate Controlled Turn-On Time: (Delay Time + Rise Time) For $V_{DX} = V_{DROM}$, I_{GT} = 300 mA, t_r = 0.1 μs, I_T = 2 A (peak), T_C = 25°C (See Fig. 4)	t_{gt}	–	0.7	–	μs
Circuit Commutated Turn-Off Time: $V_{DX} = V_{DROM}$, i_T = 10 A, pulse duration = 50 μs, dv/dt = 100 V/μs, −di/dt = −10 A/μs, I_{GT} = 100 mA, V_{GT} = 0 V (at turn-off), T_C = 80°C	t_q	–	–	8	μs
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	–	–	1.5	°C/W

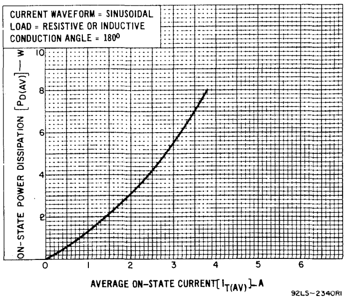


Fig. 1 — Power dissipation vs. average on-state current.

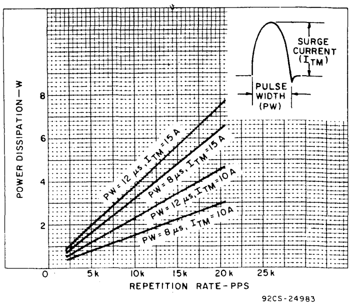


Fig. 2 — Dissipation vs. repetition rate.

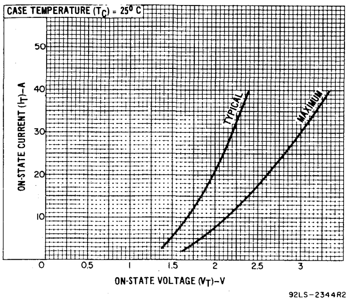


Fig. 3 – Instantaneous on-state vs. on-state voltage.

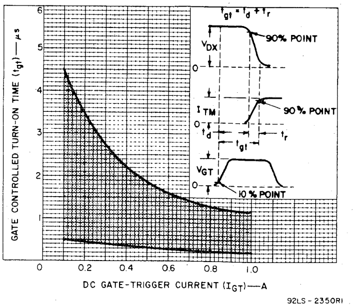


Fig. 4 – Turn-on time vs. gate-trigger current.

S6000 (2N6394-2N6398; S6000C, S6000E, S6000S)
S6100 (2N6400-2N6404; S6100C, S6100E, S6100S) Series

12-A and 16-A Silicon Controlled Rectifiers

For Power Switching, Power Control, and Ignition Applications

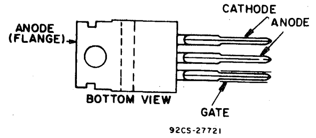
The RCA-2N6394 to 2N6398, inclusive, and 2N6400 to 2N6404, inclusive, and the S6000C, S6000E, S6000S, S6100C, S6100E, and S6100S are all-diffused silicon controlled rectifiers (reverse-blocking triode thyristors) designed for switching ac and dc currents. These devices can switch from the off-state to the on-state when both the anode and gate voltages are positive. Negative anode voltages make these devices revert to the blocking state.

The TO-220AB package provides easy package mounting and low thermal resistance, allowing operation at high case temperatures and permitting reduced heat-sink size. These SCR's can be used in lighting and motor-speed control, capacitor-discharge ignition circuits, high-voltage generators, automotive applications, and power-switching systems.

Features:

- **High dv/dt capability**
- **Low thermal resistance**
- **Shorted-emitter center gate design**
- **Low on-state voltage at high current levels**
- **Glass passivated junctions**

TERMINAL CONNECTIONS



JEDEC TO-220AB

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	2N6394 2N6400	2N6395 2N6401	2N6396 2N6402	S6000C S6100C	2N6397 2N6403	S6000E S6100E	2N6398 2N6404	S6000S S6100S	
*V_{RSOM}▲	75	125	250	350	450	550	650	750	V
V_{DSOM}▲	75	125	250	350	450	550	650	750	V
*V_{RROM}▲	50	100	200	300	400	500	600	700	V
*V_{DROM}▲	50	100	200	300	400	500	600	700	V
$I_{T(RMS)}$ $\theta = 180^{o}C$									
$T_C = 90^oC$ – 2N6394-98, S6000 series	12								A
$T_C = 100^oC$ – 2N6400-04, S6100 series	16								A
I_{TSM}:									
For one full cycle of applied principal voltage									
* 60-Hz† – 12-A types	125◆								A
16-A types	160								A
50-Hz† – 12-A types	105								A
– 16-A types	135								A
For more than one full cycle of applied principal voltage	See Fig. 7, 8								
di/dt									
$V_D = V_{DROM}$, $I_{GT} = 80$ mA, $t_r = 0.1\ \mu s$	100								A/μs
I^2t:									
$T_J = -40$ to 125^oC,									
t = 1 to 8.3 ms – 12-A types	65								A^2s
16-A types	100								A^2s
P_{GM}●:									
Peak forward for 10 μs max.	16♦								W
Peak reverse	See Fig. 13								
*$P_{G(AV)}$●:									
Averaging time = 8 ms maximum	0.5								W
I_{GM}: (forward)	2								A
*T_{stg}■	−40 to 150								°C
*T_C■	−40 to 125								°C
T_T:									
During soldering for 10 s maximum (terminal and case)	250								°C

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* In accordance with JEDEC registration data format (JS-22, RDF-1) filed for the JEDEC (2N series) types.

▲ These values do not apply if there is a positive gate signal. Gate must be open or negatively biased.

† At maximum rated $I_{T(RMS)}$.

◆ JEDEC registered value is 100 A at $T_C = 90^oC$.

● Any product of gate current and gate voltage which results in a gate power less than the maximum is permitted.

♦ JEDEC registered value is 10 W.

■ For temperature measurement reference point, see Dimensional Outline.

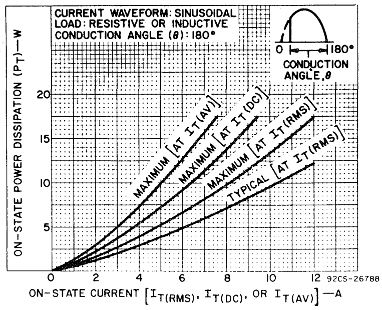


Fig. 1 — On-state power dissipation vs. on-state current for 2N6394-98, S6000 series.

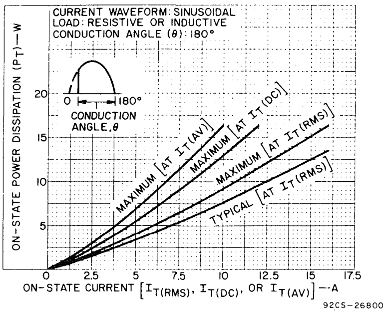


Fig. 2 — On-state power dissipation vs. on-state current for 2N6400-04, S6100 series.

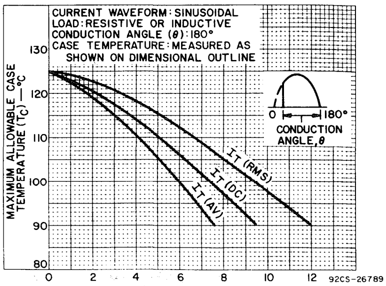


Fig. 3 — Maximum allowable case temperature vs. on-state current for 2N6394-98, S6000 series.

S6000 (2N6394-2N6398; S6000C, S6000E, S6000S) S6100 (2N6400-2N6404; S6100C, S6100E, S6100S) Series

ELECTRICAL CHARACTERISTICS, *At Maximum Ratings Otherwise Specified and at Indicated Case Temperature* (T_C)

CHARACTERISTIC	LIMITS For All Types MIN.	 TYP.	 MAX.	UNITS
I_{DOM} or I_{ROM}: $V_D = V_{DROM}$ or $V_R = V_{RROM}$, $T_C = 125°C$	–	0.1	2*	mA
v_T: (See Fig. 9, 10) i_T = 24 A (peak), T_C = 25°C (12-A types) = 32 A (peak), T_C = 25°C (16-A types)	 – –	 1.7 1.4	 2.2* 1.7*	V
i_{HO}: (See Fig. 11) T_C = 25°C T_C = –40°C	 – –	 10 –	 35 60*	mA
dv/dt: $V_D = V_{DROM}$, exponential voltage rise, T_C = 125°	50	–	–	V/μs
I_{GT} (See Fig. 14) V_D = 12 V (dc), R_L = 50Ω, T_C = 25°C V_D = 12 V (dc), R_L = 50Ω, T_C = –40°C	 – –	 8 –	 30 60*	mA
V_{GT}: (See Fig. 15) V_D = 12 V (dc), R_L = 50Ω, T_C = 25°C V_D = 12 V (dc), R_L = 50Ω, T_C = –40°C	 – –	 0.7 –	 1.5 2.5*	V
V_{GRD}: $V_D = V_{DROM}$, T_C = 125°C	0.2	–	–	V
t_{gt}: $V_D = V_{DROM}$, i_T = 24 A (peak), I_{GT} = 200 mA, t_r = 0.02 μs, T_C = 25°C	–	–	2*	μs
t_q: Rectangular Pulse $V_D = V_{DROM}$, $i_T = I_{T(RMS)}$, pulse duration = 50 μs, dv/dt = 50 V/μs, –di/dt = –10 A/μs, I_{GT} = 80 mA at turn-on, V_R = 20 V minimum, V_{GK} = 0 V at turn-off, T_C = 75°C	–	35	75	μs
$R_{\theta JC}$	–	–	2*	°C/W
$R_{\theta JA}$	–	–	50*	

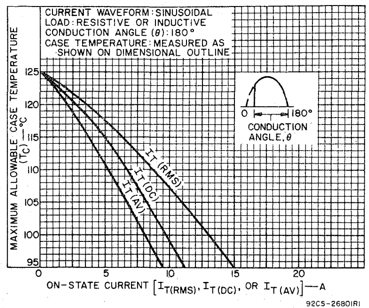


Fig. 4 — Maximum allowable case temperature vs. on-state current for 2N6400-04, S6100 series.

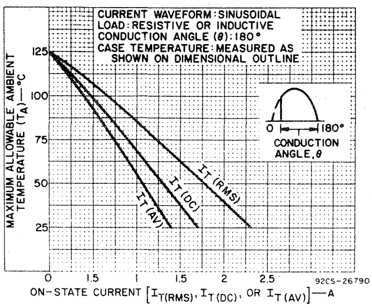


Fig. 5 — Maximum allowable ambient temperature vs. on-state current — no heat sinking for 2N6394-98, S6000 series.

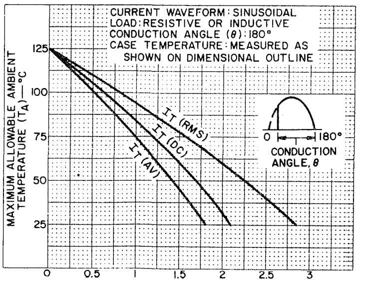


Fig. 6 — Maximum allowable ambient temperature vs. on-state current — no heat sinking for 2N6400-04, S6100 series.

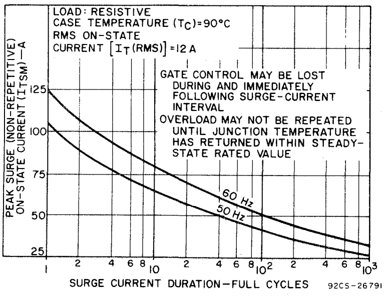


Fig. 7 — Allowable peak surge on-state current vs. surge duration for 2N6394-2N6398 and S6000 series.

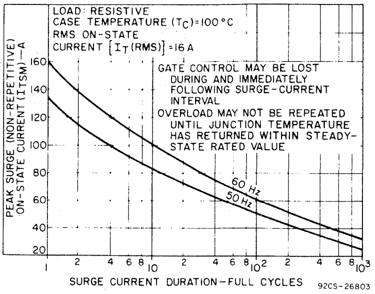


Fig. 8 — Allowable peak surge on-state current vs. surge duration for 2N6400-2N6404 and S6100 series.

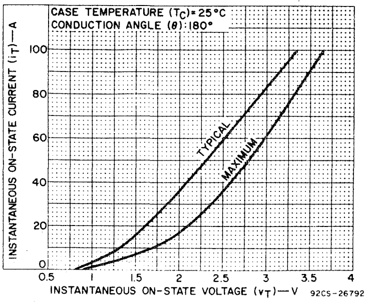


Fig. 9 — Instantaneous on-stage current vs. instantaneous on-state voltage for 2N6394–2N6398 and S6000 series.

S6000 (2N6394-2N6398; S6000C, S6000E, S6000S)
S6100 (2N6400-2N6404; S6100C, S6100E, S6100S) Series

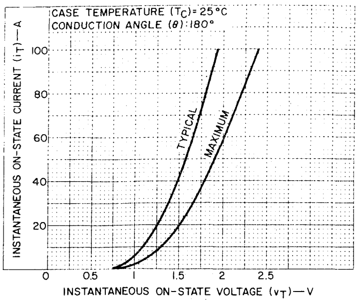


Fig. 10 – Instantaneous on-state current vs. instantaneous on-state voltage for 2N6400–2N6404 and S6100 series.

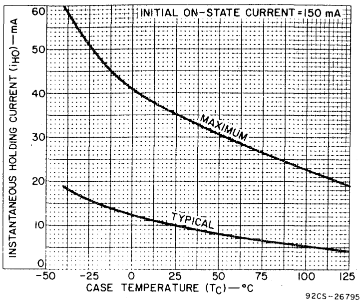


Fig. 11 – Instantaneous holding current vs. case temperature for all types.

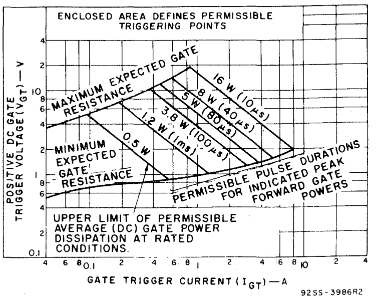


Fig. 12 – Gate trigger characteristics and limiting conditions for determination of permissible gate-trigger plulses for all types.

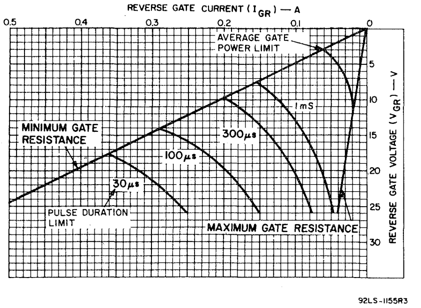


Fig. 13 – Reverse gate characteristics for all types.

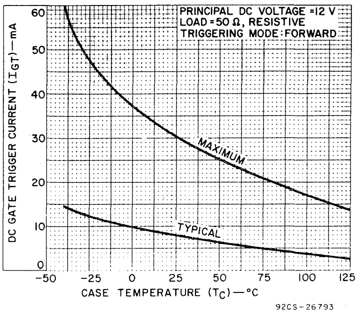


Fig. 14 – DC gate trigger current vs. case temperature for all types.

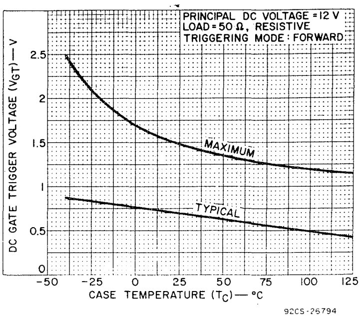


Fig. 15 – DC gate trigger voltage vs. case temperature for all types.

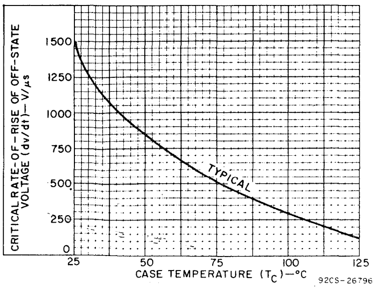


Fig. 16 – Critical rate of rise of off-state voltage vs. case temperature for all types.

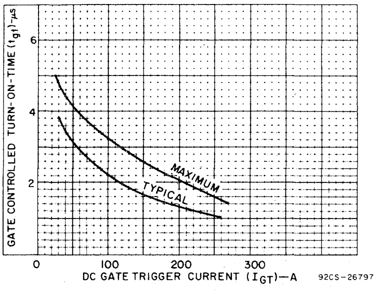


Fig. 17 – Typical gate-controlled turn-on time vs. gate trigger current for all types.

S6200, S6210, S6220 Series

20-Ampere Silicon Controlled Rectifiers

Press-Fit, Stud, and Isolated-Stud Packages

These RCA types are all-diffused, silicon controlled rectifiers (reverse-blocking triode thyristors) designed for power switching and voltage regulator applications and for heating, lighting and motor speed-control circuits.

These SCRs have an RMS on-state current rating ($I_{T\ [RMS]}$) of 20 A and have voltage ratings (V_{DROM}) of 100, 200, 400, and 600 volts.

The S6200 SCR series employs a hermetic press-fit package, the S6210 series employs a hermetic stud package, and the S6220 series emplovs a hermetic isolated-stud package.

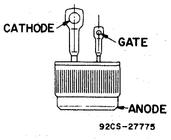
Features:

- Low switching losses
- High di/dt and dv/dt capabilities
- Shorted-emitter gate-cathode construction
- Forward and reverse gate dissipation ratings
- All-diffused construction—assures exceptional uniformity and stability of characteristics
- Symmetrical gate-cathode construction—provides uniform current density, rapid electrieal conduction, and efficient heat dissipation
- Low leakage currents, both forward and reverse
- Low forward voltage drop at high current levels
- Low thermal resistance

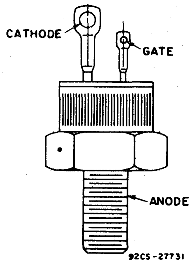
MAXIMUM RATINGS, *Absolute-Maximum Values:*

		S6200A S6210A S6220A	S6200B S6210B S6220B	S6200D S6210D S6220D	S6200M S6210M S6220M	
NON-REPETITIVE PEAK REVERSE VOLTAGE						
Gate Open	V_{RSOM}	150	250	500	700	V
NON-REPETITIVE PEAK FORWARD VOLTAGE						
Gate Open	V_{DSOM}	150	250	500	700	V
REPETITIVE PEAK REVERSE VOLTAGE						
Gate Open	V_{RROM}	100	200	400	600	V
REPETITIVE PEAK OFF-STATE VOLTAGE						
Gate Open	V_{DROM}	100	200	400	600	V
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:						
For one cycle of applied principal voltage $T_C = 75^oC$	I_{TSM}					
50-Hz, (sinusoidal)		170				A
60-Hz, (sinusoidal)		200				A
For more than one full cycle of applied principal voltage		See Fig. 3				
ON-STATE CURRENT:						
For case temperature (T_C) = 75° C, conduction angle of 180°						
Average DC value	$I_{T(AV)}$	12.5				A
RMS value	$I_{T(RMS)}$	20				A
RATE-OF-CHANGE OF ON-STATE CURRENT:						
$V_{DM} = V_{(BO)O}, I_{GT} = 200$ mA, $t_r = 0.5\ \mu s$	di/dt	200				A/μs
FUSING CURRENT (for SCR protection):						
$T_J = -65$ to 100^oC, t = 1 to 8.3 ms	I^2t	170				A^2s
GATE POWER DISSIPATION:						
PEAK FORWARD (for 10 μs max.)	P_{GM}	40				W
AVERAGE (averaging time = 10 ms, max.)	$P_{G(AV)}$	0.5				W
PEAK REVERSE	P_{RGM}	See Fig. 10				
TEMPERATURE RANGE:						
Storage		−65 to 150				°C
Operating (Case)		−65 to 100				°C
Soldering (10 s max. for terminals)		225				°C

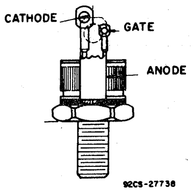
TERMINAL CONNECTIONS



Press-Fit Types



Stud Types



Isolated-Stud Types

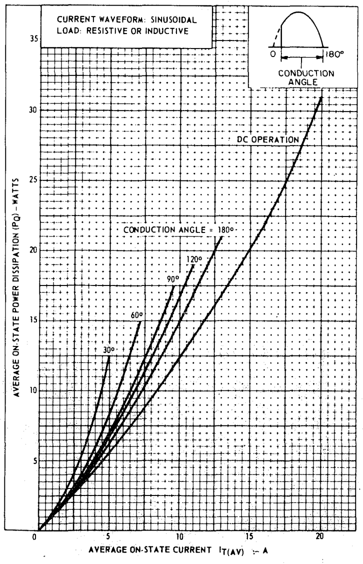


Fig. 1 —Power dissipation vs. on-state current.

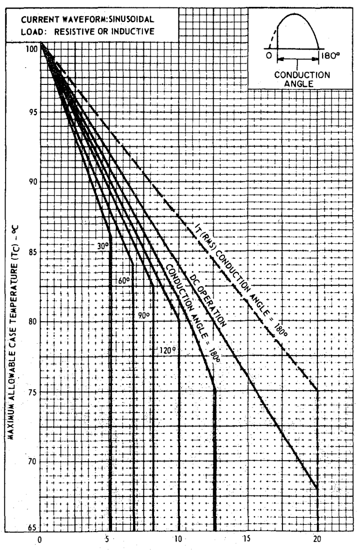


Fig. 2 —Maximum allowable case temperature vs. average forward current for stud and press-fit.

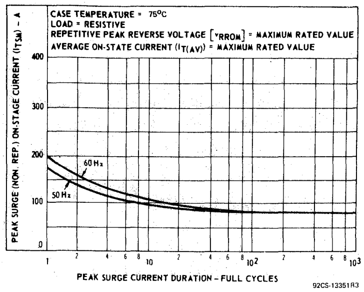


Fig. 3 —Peak surge on-state current vs. surge current duration.

S6200, S6210, S6220 Series

ELECTRICAL CHARACTERISTICS

At Maximum Ratings and at Indicated Case Temperature (T_C) Unless Otherwise Specified

CHARACTERISTIC	SYMBOL	LIMITS - ALL TYPES			UNITS
		Min.	Typ.	Max.	
Instantaneous Forward Breakover Voltage: (Gate open, T_C = 100 °C) **S6200A, S6210A, S6220A** .... **S6200B, S6210B, S6220B** .... **S6200D, S6210D, S6220D** **S6200M, S6210M, S6220M**	$V_{(BO)O}$	100 200 400 600	- - - -	- - - -	V
Peak Off-State Current: (Gate open, T_C = 100 °C) Forward, $V_{DO} = V_{DROM}$	I_{DOM}	-	0.2	3	mA
Reverse, $V_{RO} = V_{RROM}$	I_{RROM}	-	0 1	2	
Instantaneous On-State Voltage: For i_T = 100 A, T_C = 25 °C	v_T	-	1.9	2.4	V
DC Gate Trigger Current: V_D = 12 V (DC), R_L = 30Ω, T_C = 25 °C .... At other case temperatures	I_{GT}	-	8 See Fig. 8	15	mA
DC Gate Trigger Voltage: V_D = 12 V (DC), R_L = 30Ω, T_C = 25 °C .... At other case temperatures	V_{GT}		1.1 See Fig. 9	2	V
Instantaneous Holding Current: Gate open, T_C = 25 °C .... At other case temperatures	I_{HO}		9 See Fig. 6	20	mA
Critical Rate-of-Rise of Off-State Voltage: ($V_{DO} = v_{(BO)O}$ Min. value, Exponential rise, T_C 100°C,) **S6200A, S6200D, S6210A, S6210D, S6220A, S6220D** .... **S6200B, S6210B, S6220B** **S6200M, S6210M, S6220M**	dv dt	10 10 10	100 150 75	- - -	V/.s
Gate Controlled Turn-On Time: V_D = $v_{(BO)O}$ Min. value, i_T 30 A, I_{GT} 200 mA, 0.1 μs rise time, T_C 25°C See Fig. *11*	t_{gt}	-	2	-	μs
Circuit Commutated Turn-Off Time: V_D · $V_{F(BO)O}$ Min. value, i_T 18 A, Pulse Duration · 50 μs, **dv/dt = 20 V/μs, di/dt = –30 A/μs, T_C = 75°C**	t_q	–	20	40	μs
Thermal Resistance: Junction-to-Case **(press-fit, stud packages)** .... Junction-to-Isolated Stud **(Isolated-stud package)**	$R_{\theta JC}$ $R_{\theta JIS}$	- -	- -	1.2 1.4	°C/W

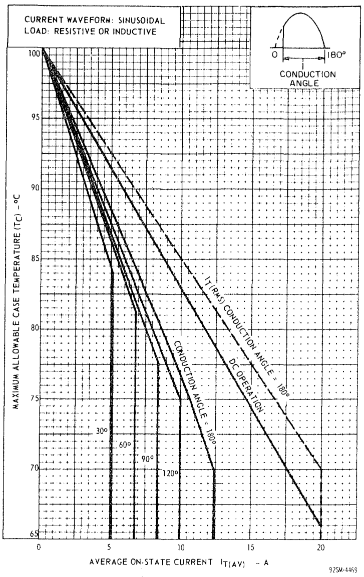


Fig. 4 – Maximum allowable case temperature vs. average forward current for isolated stud.

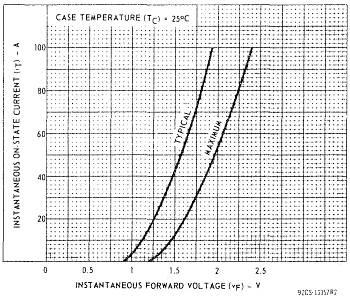


Fig. 5 – Instantaneous on-state current vs. on-state voltage.

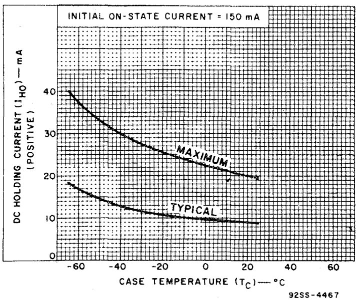


Fig. 6 – DC holding current vs. case temperature.

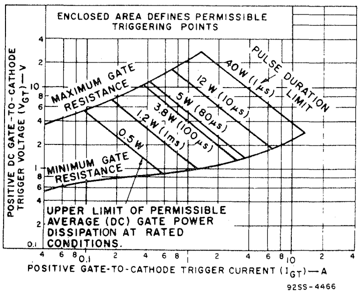


Fig. 7 – Typical forward-biased gate trigger characteristics.

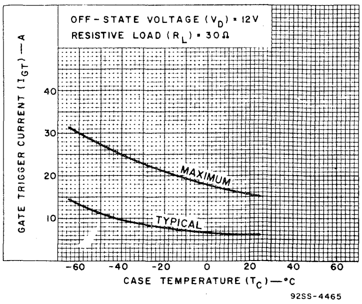


Fig. 8 – DC gate-trigger current (forward) vs. case temperature.

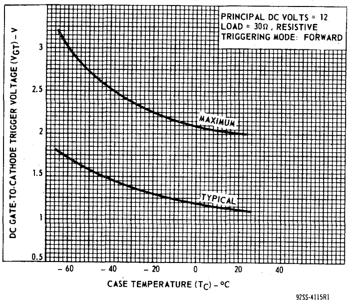


Fig. 9 — DC gate-trigger voltage vs. case temperature.

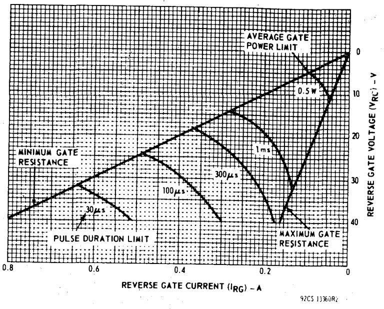


Fig. 10 — Reverse gate voltage vs. reverse gate current.

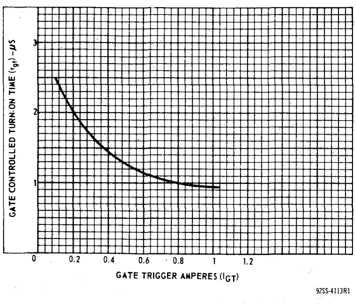


Fig. 11 — Gate controlled turn-on time (t_{gt}) vs. gate-trigger current.

WARNING: The ceramic of the isolated stud package contains beryllium oxide. Do not crush, grind, or abrade this part because the dust resulting from such action may be hazardous if inhaled. Disposal should be by burial.

S6230, S6240, S6250, S6430, S6440, S6450 Series

20- and 35-A Silicon Controlled Rectifiers

For General-Purpose Phase-Control Applications

These RCA silicon controlled rectifiers (reverse-blocking triode thyristors) are designed for general-purpose phase-control applications.

The S6230, S6240, and S6250 series have current ratings of 20 amperes. SCR's in each series have voltage ratings of 100, 200, 400, and 600 volts. The S6430, S6440, and S6450 series have current ratings of 35 amperes. SCR's in each series have voltage ratings of 100, 200, 400, 600, and 800 volts.

The S6230 and S6430 series employ a press-fit package with flexible leads, encapsulated on an isolated stud. The S6240 and S6440 series employ a press-fit package isolated on a TO-3 flange. The S6250 and S6450 series employ a press-fit package with flexible leads, encapsulated on an isolated TO-3 flange.

20-A SCR's – S6230, S6240, and S6250 Series
Electrical and Mechanical Data

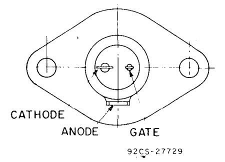
		On-State Current			Wire Size		Wire Insulation Thickness		
Type No.	Rep. Peak Off-State Voltage V_{DROM} (V)	I_T (RMS) (A)	T_C (°C)	Package (Press-fit)	Cathode Anode Gage No.	Gate Gage No.	Cathode Anode in. (mm)	Gate in. (mm)	Refer to Bulletin File No.*
S6230A	100	20	70	With flex.leads, encap. on isolated-stud	14	22	0.031 (0.787)	0.016 (0.406)	418
S6230B	200								
S6230D	400								
S6230M	600								
S6240A	100	20	70	Isolated on TO-3 flange	–	–	–	–	418
S6240B	200								
S6240D	400								
S6240M	600								
S6250A	100	20	70	With flex.leads, encap., isolated on TO-3 flange	14	22	0.031 (0.787)	0.016 (0.406)	418
S6250B	200								
S6250D	400								
S6250M	600								

35-A SCR's – S6430, S6440, and S6450 Series
Electrical and Mechanical Data

S6430A	100	35	65	With flex.leads, encap. on isolated-stud	12	22	0.034 (0.863)	0.016 (0.406)	578
S6430B	200								
S6430D	400								
S6430M	600								
S6440A	100	35	65	Isolated on TO-3 flange	–	–	–	–	578
S6440B	200								
S6440D	400								
S6440M	600								
S6450A	100	35	65	With flex.leads, encap., isolated on TO-3 flange	12	22	0.034 (0.863)	0.016 (0.406)	578
S6450B	200								
S6450D	400								
S6450M	600								

Features:
- **3-kV rms encapsulant (HYPOT) breakdown voltage**
- **Flame-resistant encapsulant (self-extinguishing)**
- **Rugged packages**
- **Standard RCA SCR features**

TERMINAL CONNECTIONS



S6240 S6440

FLEXIBLE-LEAD (TERMINAL) CONNECTIONS

Flexible-Lead (Insulation) Color	Terminal
White	Gate
Red	Cathode
Black	Anode

Note: Terminals are identified by color code only. Position of the flexible leads (relative to terminals of the device) leaving the encapsulant is random.

Press-Fit with Flexible Leads, Encapsulated on Isolated-Stud

S6230 S6430

Press-Fit with Flexible Leads, Encapsulated, Isolated on TO-3 Flange

S6250 S6450

WARNING: The ceramic used in these packages contains beryllium oxide. Do not crush, grind, or abrade these portions because the dust resulting from such action may be hazardous if inhaled. Disposal should be by burial.

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* Electrical characteristics and ratings given in these bulletins also apply to the types listed in this chart.

S6400(2N3870-2N3873)S6410(2N3896-2N3899)
S6420 Series

35-A Silicon Controlled Rectifiers

These RCA types are all-diffused, silicon controlled rectifiers (reverse-blocking triode thyristors) designed for power switching, power control, and voltage regulator applications and for heating, lighting, and motor speed-control circuits.

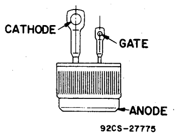
The 2N3870-73 and S6400N employ a hermetic press-fit package.

The 2N3896-99 and S6410N employ a hermetic stud package. The S6420 series employ a hermetic isolated-stud package.

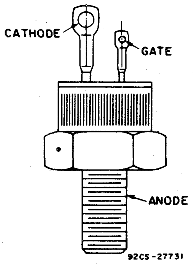
Features:

- **High di/dt and dv/dt capabilities**
- **Low on-state voltage at high current levels**
- **Low thermal resistance**
- **Shorted-emitter center-gate construction**

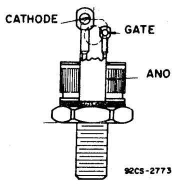
TERMINAL CONNECTIONS



Press-Fit Types



Stud Types



Isolated-Stud Types

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		2N3870 2N3896 S6420A	2N3871 2N3897 S6420B	2N3872 2N3898 S6420D	2N3873 2N3899 S6420M	
***NON-REPETITIVE PEAK REVERSE VOLTAGE▲**						
Gate Open	V_{RSOM}	150	330	660	700	V
NON-REPETITIVE PEAK OFF-STATE VOLTAGE▲						
Gate Open	V_{DSOM}	150	330	660	700	V
***REPETITIVE PEAK REVERSE VOLTAGE▲**						
Gate Open	V_{RROM}	100	200	400	600	V
***REPETITIVE PEAK OFF-STATE VOLTAGE▲**						
Gate Open	V_{DROM}	100	200	400	600	V
ON-STATE CURRENT:						
T_C = 65°C◆, conduction angle = 180°:						
RMS	$I_{T(RMS)}$	35				A
* Average	$I_{T(AV)}$	22				A
For other conditions		See Figs. 2 & 4				
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:	I_{TSM}					
For one full cycle of applied principal voltage , T_C = 65°C						
* 60 Hz (sinusoidal)		350				A
50 Hz (sinusoidal)		300				A
For more than one full cycle of applied principal voltage		See Fig. 3				
RATE OF CHANGE OF ON-STATE CURRENT						
$V_D = V_{DROM}$, I_{GT} = 200 mA, t_r = 0.5 μs	di/dt	200				A/μs
FUSING CURRENT (for SCR protection):						
T_J = -40 to 100°C, t = 1 to 8.3 ms	I^2t	300				A^2s
GATE POWER DISSIPATION●:						
Peak Forward (for 10 μs max., See Fig. 7)	P_{GM}	40				W
Peak Reverse	P_{RGM}	See Fig. 8				
Average (averaging time = 10 ms max.)	$P_{G(AV)}$	0.5				W
***TEMPERATURE RANGE■:**						
Storage	T_{stg}	-40 to 125				°C
Operating (Case)	T_C	-40 to 100				°C
TERMINAL TEMPERATURE (During soldering):	T_T					
For 10 s max. (terminals and case)		225				°C

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* In accordance with JEDEC registration data filed for the JEDEC (2N-series) types.

▲ These values do not apply if there is a positive gate signal. Gate must be open or negatively biased.

◆ T_C = 60° for isolated-stud package types.

● Any product of gate current and gate voltage which results in a gate power less than the maximum is permitted.

■ Temperature measurement point is shown on the DIMENSIONAL OUTLINE.

WARNING: The ceramic of the isolated stud package contains beryllium oxide. Do not crush, grind, or abrade this part because the dust resulting from such action may be hazardous if inhaled. Disposal should be by burial.

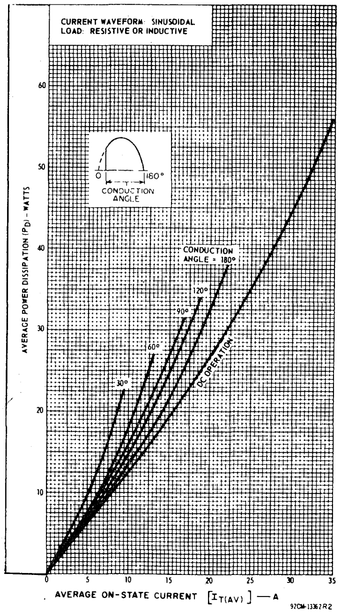


Fig.1 — Power dissipation vs. on-state current.

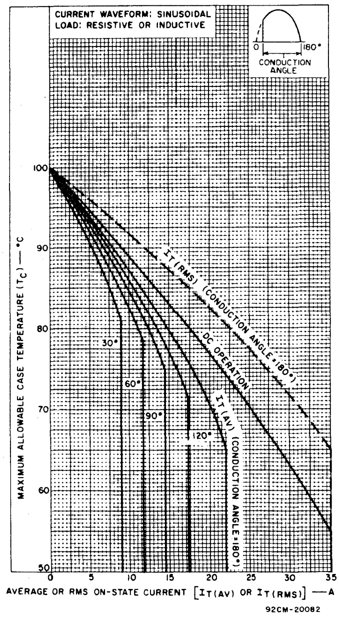


Fig.2 — Maximum allowable case temperature vs. on-state current for press-fit and stud types.

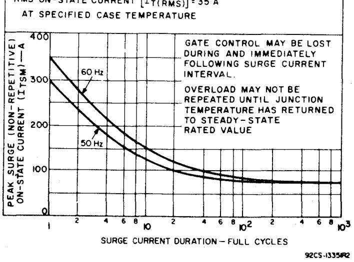


Fig.3 — Peak surge on-state current vs. surge current duration.

S6400(2N3870-2N3873) S6410(2N3896-2N3899)
S6420 Series

ELECTRICAL CHARACTERISTICS

At Maximum Ratings Unless Otherwise Specified and at Indicated Case Temperature (T_C)

CHARACTERISTIC	SYMBOL	LIMITS			UNITS
		FOR ALL TYPES Unless Otherwise Specified			
		MIN.	TYP.	MAX.	
Peak Off-State Current: (Gate open, T_C = 100°C) Forward Current (I_{DOM}) at V_D = V_{DROM} Reverse Current (I_{ROM}) at V_R = V_{RROM}	I_{DOM} or I_{ROM}				
2N3870, 2N3896, S6420A		–	0.2	2*	mA
2N3871, 2N3897, S6420B		–	0.25	2.5*	
2N3872, 2N3898, S6420D		–	0.3	3*	
2N3873, 2N3899, S6420M,					
Instantaneous On-State Voltage: i_T = 69 A (peak), T_C = 25°C . . . . i_T = 100 A (peak), T_C = 25°C	v_T	– –	– 1.7	1.85* 2.1	V
DC Gate Trigger Voltage: V_D = 12 V (dc), R_L = 30 Ω, T_C = -40°C V_D = 12 V (dc), R_L = 30 Ω, T_C = 25°C For other case temperatures	V_{GT}	– –	1.5 1.1 See Fig. 10	.3* 2	V
DC Gate Trigger Current: V_D = 12 V (dc), R_L = 30 Ω, T_C = -40°C V_D = 12 V (dc), R_L = 30 Ω, T_C = 25°C For other case temperatures	I_{GT}	– 1	46 25 See Fig. 9	80* 40	mA
Instantaneous Holding Current: Gate open, T_C = 25°C . . . . For other case temperatures	i_{HO}	0.5	30 See Fig. 6	70	mA
Gate Controlled Turn-On Time: (Delay Time + Rise Time) For V_D = V_{DROM}, I_{GT} = 200 mA, t_r = 0.1 μs, I_T = 30 A (peak), T_C = 25°C	t_{gt}	–	1.25	2	μs
Circuit Commutated Turn-Off Time: V_D = V_{DROM}, i_T = 18 A, pulse duration = 50 μs, dv/dt = 20 V/μs, -di/dt = -30 A/μs, I_{GT} = 200 mA, T_C = 80°C	t_q	–	20	40	μs
Critical Rate of Rise of Off-State Voltage: V_D= V_{DROM}, exponential voltage rise, Gate open, T_C = 100°C	dv/dt	10	100	–	V/μs
Thermal Resistance, Junction-to-Case: Steady-State Press-fit & stud types . . . . Isolated-stud types	$R_{\theta JC}$	– –	– –	0.9* 1	°C/W

*In accordance with JEDEC registration data filed for the JEDEC (2N-series) types.

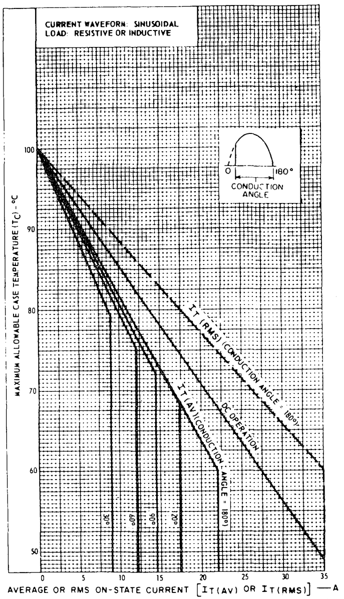


Fig.4 — Maximum allowable case temperature vs. on-state current for isolated-stud types.

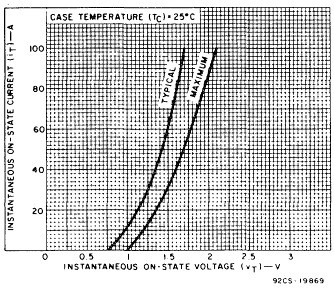


Fig.5 — Instantaneous on-state current vs. on-state voltage.

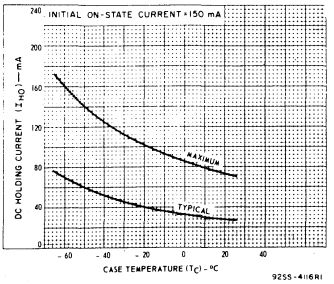


Fig.6 — DC holding current vs. case temperature.

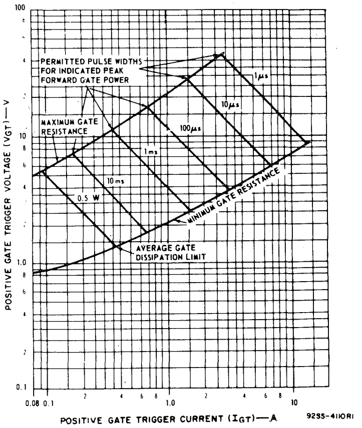


Fig.7 — Gate pulse characteristics for forward triggering mode.

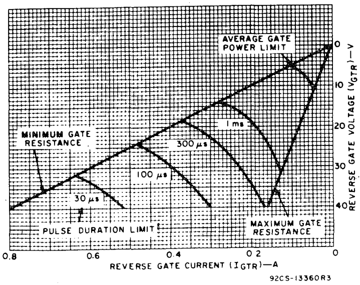


Fig.8 — Reverse gate voltage vs. reverse gate current.

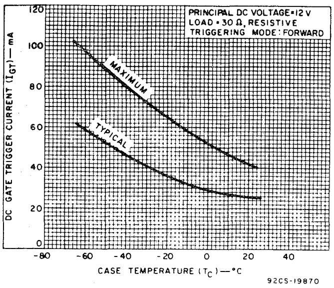


Fig.9 — DC gate trigger current (forward) vs. case temperature.

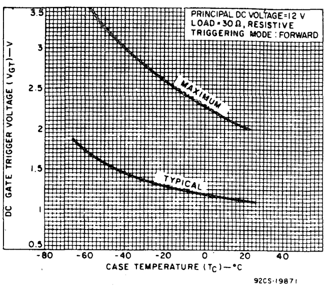


Fig.10 — DC gate trigger voltage (forward) vs. case temperature.

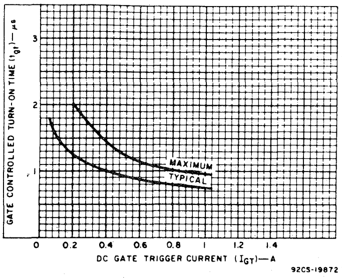


Fig.11 — Gate-controlled turn-on time vs. gate trigger current.

S6431(2N681-2N690) S6432(2N1842A-2N1850A) Series

16-A and 25-A Silicon Controlled Rectifiers for Power-Control and Power-Switching Applications

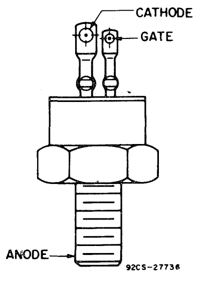
The RCA 2N681-2N690 and the 2N1842A-2N1850A are all-diffused silicon controlled rectifiers (reverse-blocking triode thrysistors) designed for switching ac and dc currents. These devices can switch from the off-state to the on-state when both the anode and gate voltages are positive. Negative anode voltages make these devices revert to the blocking state.

These SCR's employ a hermetic JEDEC TO-48 package.

Features:

- **High di/dt capability**
- **Low on-state voltage at high current levels**
- **Low thermal resistance**
- **Shorted-emitter center-gate construction**

TERMINAL CONNECTIONS



JEDEC TO-48

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	2N681 2N1842A	2N682 2N1845A	2N683 2N1844A	2N684 2N1845A	2N685 2N1846A	2N686 2N1847A	2N687 2N1848A	2N688 2N1849A	2N689 2N1850A	2N690 —	
*V_{RSOM}▲	35	75	150	225	300	350	400	500	600	700	V
*V_{RROM}▲	25	50	100	150	200	250	300	400	500	600	V
*V_{DROM}▲	25	50	100	150	200	250	300	400	500	600	V

$I_{T(RMS)}$ (θ = 180°):		
T_C = 80°C, (2N1842A-2N1850A)	16	A
= 65°C, (2N681-2N690)	25	A
*$I_{T(AV)}$ (θ = 180°):		
T_C = 80°C (2N1842A-2N1850A)	10	A
= 65°C (2N681-2N690)	16	A
I_{STM}:		
For one full cycle of applied principal voltage		
* 60Hz† (2N1842A-2N1850A)	125	A
* 60Hz♠ (2N681-2N690)	150	A
50Hz† (2N1842A-2N1850A)	115	A
50Hz♠ (2N681-2N690)	140	A
For more than one full cycle of applied principal voltage	See Figs. 3, 4	
di/dt:		
V_D = V_{DROM}, I_{GT} = 200 mA, t_r = 0.5 μs	200	A/μs
I^2t [at T_C shown for $I_{T(RMS)}$]:		
t = 10 ms (2N1842A-2N1850A)	68	A^2s
(2N681-2N690)	100	A^2s
= 1 ms (2N1842A-2N1850A)	32	A^2s
(2N681-2N690)	46	A^2s
*P_{GM}●:	5	W
*$P_{G(AV)}$●:	0.5	W
*I_{GM}	2	A
*V_{GM}	10	V
*V_{GRM}	5	V
*T_{stg}■ (2N1842A-2N1850A)	−65 to 125	°C
(2N681-2N690)	−65 to 150	°C
*T_C■	−65 to 125	°C
T_T:		
During soldering for 10 s maximum (terminal and case)	225	°C
τ_s: Recommended	35	in-lb
	0.4	kgf-m
Maximum (DO NOT EXCEED)	50	in-lb
	0.57	kgf-m

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* In accordance with JEDEC registration data.

▲ These values do not apply if there is a positive gate signal. Gate must be open or negatively biased.

† At $I_{T(RMS)}$ = 16 A and T_C = 80°C

♠ At $I_{T(RMS)}$ = 25 A and T_C = 65°C

● Any product of gate current and gate voltage which results in a gate power less than the maximum is permitted.

■ For temperature measurement reference point, see Dimensional Outline.

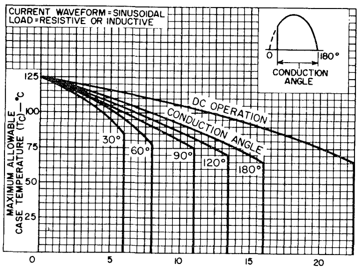


Fig. 1 — Maximum allowable case temperature vs. on-state current for 2N681 - 2N690.

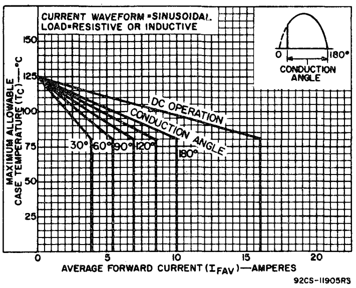


Fig. 2 — Maximum allowable case temperature vs. on-state current for 2N1842A-2N1850A.

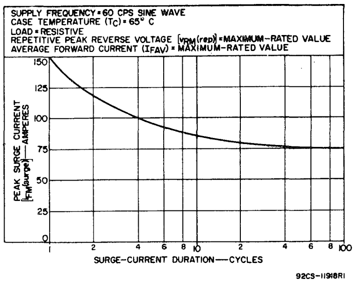


Fig. 3 — Peak surge on-state current vs. surge duration for 2N681-2N690.

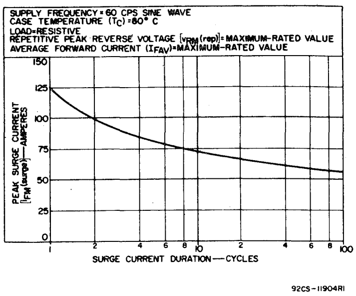


Fig. 4 — Peak surge on-state current vs. surge duration for 2N681-2N690.

S6431(2N681-2N690) S6432 (2N1842A-2N1850A) Series

ELECTRICAL CHARACTERISTICS, *At Maximum Ratings Unless Otherwise Specified and at Indicated Case Temperature (T_C)*

CHARACTERISTIC	LIMITS						UNITS
	2N681-2N690			2N1842A-2N1850A			
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
* I_{DROM} or I_{RROM}:							mA
$V_D = V_{DROM}$ or $V_R = V_{RROM}$, $T_C = 125°C$:							
2N681, 2N682, 2N683, 2N684	–	–	6.5	–	–	–	
2N685	–	–	6	–	–	–	
2N686	–	–	5.5	–	–	–	
2N687	–	–	5	–	–	–	
2N688	–	–	4	–	–	–	
2N689	–	–	3	–	–	–	
2N690	–	–	2.5	–	–	–	
$V_D = V_{DROM}$ or V_{RROM}, $T_C = 80°C$:							
2N1842A	–	–	–	–	–	22.5	
2N1843A	–	–	—	–	–	19	
2N1844A	–	–	–	–	–	12.5	
2N1845A	–	–	–	–	–	6.5	
2N1846A	–	–	–	–	–	6	
2N1847A	–	–	–	–	–	5.5	
2N1848A	–	–	–	–	–	5	
2N1849A	–	–	–	–	–	4	
2N1850A	–	–	–	–	–	3	
* v_T:							V
$i_T = 30$ A (peak), $T_C = 25°C$	–	–	–	–	–	2.5	
$= 50$ A (peak), $T_C = 25°C$	–	–	2	–	–	–	
$v_{T(AV)}$:							V
$I_T = I_{T(RMS)} = T_C = 65°C$	–	–	0.86	–	–	–	
$= 80°C$	–	–	–	–	–	1.2	
i_{HO}:							
$T_C = 125°C$	–	15	–	–	8	–	mA
I_{GT}:							mA
$T_C = 125°C$	–	–	25	–	–	4.5	
$V_D = 12$ V (dc), $R_L = 50\Omega$, $T_C = 25°C$	–	–	80*	–	–	150*	
* V_{GT}:							V
$V_D = 12$ V (dc), $R_L = 50\Omega$, $T_C = -65$ to $125°C$	–	–	3	–	–	–	
$= 125°C$	0.25	–	–	0.25	–	–	
$= -40°C$	–	–	–	–	–	3.5	
$= -65°C$	–	–	–	–	–	3.7	
$= 100°C$	–	–	–	0.3	–	–	
$R_{\theta JC}$	–	–	2	–	–	2	°C/W

*In accordance with JEDEC registration data.

▲ These values do not apply if there is a positive gate signal. Gate must be open or negatively biased.

● Any product of gate current and gate voltage which results in a gate power less than the maximum is permitted.

S6431(2N681-2N690) S6432(2N1842A-2N1850A) Series

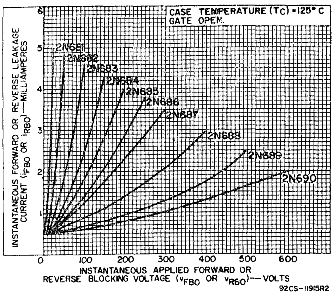


Fig. 5 — Typical peak off-state current or peak reverse current vs. off-state or reverse voltage for 2N681-2N690.

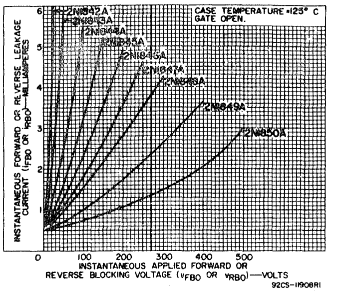


Fig. 6 — Typical peak off-state current or peak reverse current vs. off-state or reverse voltage for 2N1842A-2N1850A.

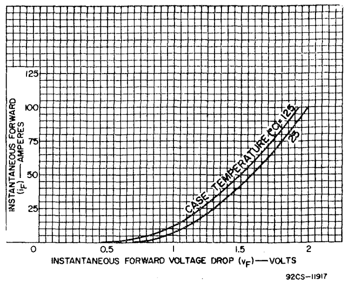


Fig.7 — Typical on-state current vs. instantaneous on-state voltage for 2N681—2N690.

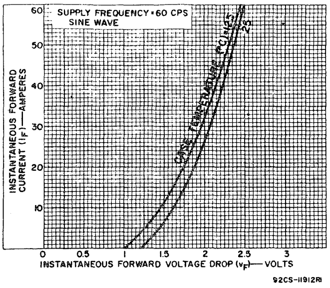


Fig.8 — Typical on-state current vs. instantaneous on-state voltage for 2N1842A—2N1850A.

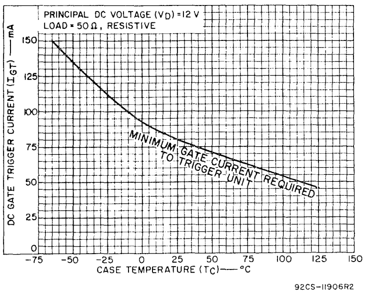


Fig. 9 — DC gate-trigger current vs. case temperature for 2N1842A-2N1850A.

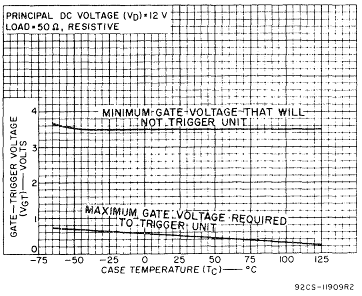


Fig. 10 — DC gate-trigger voltage vs. case temperature for 2N1842A-2N1850A.

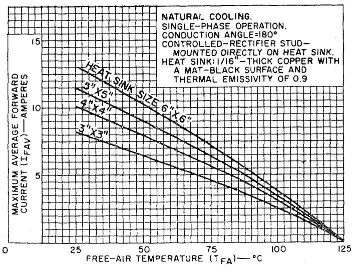


Fig.11 — Average on-state forward current vs. ambient temperature for 2N681—2N690.

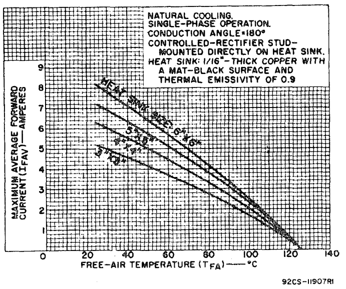


Fig.12 — Average on-state forward current vs. ambient temperature for 2N1842A—2N1850A.

S6493M

Silicon Controlled Rectifier for High-Current Pulse Applications

The RCA-S6493M* is an all-diffused silicon controlled rectifier (reverse-blocking triode thyristor) designed especially for use in radar pulse modulators, inverters, switching regulators, and other applications requiring a large ratio of peak to average current.

It is especially constructed for rapid spread of forward current over the full junction area to achieve a high rate of change of forward current (di/dt) capability and low switching dissipation.

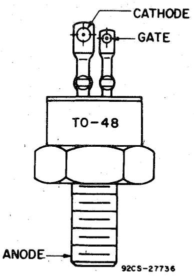
The S6493M employs a hermetic JEDEC TO-48 package.

*Formerly RCA Type No. S6431M.

Features:

- Up to 900 A peak pulse on-state current
- 30 W maximum average dissipation
- On-state current of 35 A (rms value)
- Shorted-emitter center-gate design

TERMINAL CONNECTIONS



JEDEC TO-48

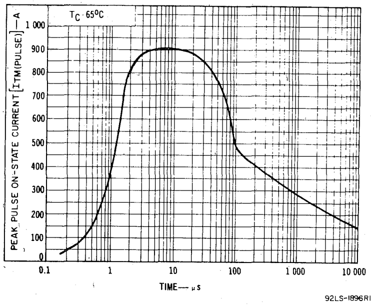


Fig.1 — Peak pulse on-state current vs. time.

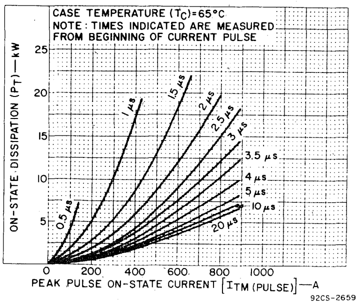


Fig.2 — On-state dissipation vs. peak pulse on-state current and time.

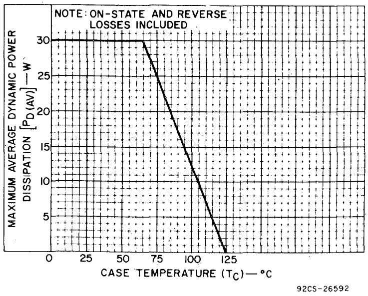


Fig.3 — Dissipation derating curve.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

V_{RSOM}▲	700	V
V_{DSOM}▲	700	V
V_{RROM}▲	600	V
V_{DROM}▲	600	V
$I_{T(RMS)}$ (T_C = 65°C, θ = 180°)	35	A
$I_{TM(pulse)}$:		
T_C = 65°C, See Figs. 1 and 2	900	A
I^2t:		
T_J = −65 to 125°C, t = 1 to 8.3 ms	2000	A^2s
$P_{D(AV)}$ (T_C = 65°C, See Fig. 3)	30	W
P_{GM}●:		
Peak (forward or reverse) for 10 μs maximum, See Fig. 4	40	W
$P_{G(AV)}$●:		
Averaging time = 10 ms maximum	1	W
T_{stg}■	−65 to 150	°C
T_C■	−65 to 125	°C
T_T:		
During soldering for 10 s maximum (terminals and case)	225	°C
τ_s:		
Recommended	35 0.4	in-lbf kgf-m
Maximum (DO NOT EXCEED)	50 0.57	in-lbf kgf-m

▲ These values do not apply if there is a positive gate signal. Gate must be open or negatively biased.

● Any product of gate current and gate voltage which results in a gate power less than the maximum is permitted.

■ For temperature measurement reference point, *see Dimensional Outline.*

ELECTRICAL CHARACTERISTICS

At Maximum Ratings Unless Otherwise Specified and at Indicated Case Temperature (T_C)

CHARACTERISTIC	LIMITS			UNITS
	MIN.	TYP.	MAX.	
I_{DOM} or I_{ROM}: V_D = V_{DROM} or V_R = V_{RROM}, T_C = 125°C	–	2	10	mA
$V_{T(I)}$ $I_{TM(pulse)}$ = 600 A, t = 2 μs, T_C = 65°C (See Fig. 7)	–	–	19	V
I_{HO}: T_C = 25°C	0.5	20	70	mA
dv/dt: V_D = V_{DROM}, exponential voltage rise, T_C = 125°C	20	50	–	V/μs
I_{GT} (T_C = 25°C), See Fig.4	1	25	80	mA
V_{GT} (T_C = 25°C), See Fig.4	–	1.1	2	V
t_{gt}: V_D = V_{DROM}, i_T = 30 A (peak), I_{GT} = 200 mA, t_r = 0.1 μs, T_C = 25°C	–	1.25	–	μs
t_q: Rectangular Pulse V_{DX} = V_{DROM}, i_T 18 A, pulse duration = 50 μs, dv/dt = 20 V/μs, – di/dt = −30 A/μs, I_{GT} = 200 mA at turn-on, T_C = 80°C	15	20	40	μs
$R_{\theta JC}$	–	–	2	°C/W

S6493M

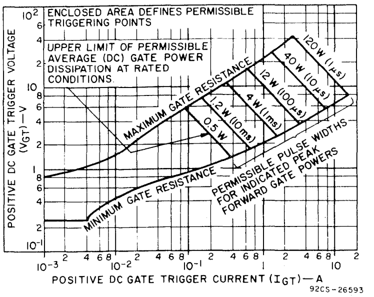


Fig.4 — Forward-bias gate-trigger characteristics and limiting conditions for determination of premissible gate-trigger pulses.

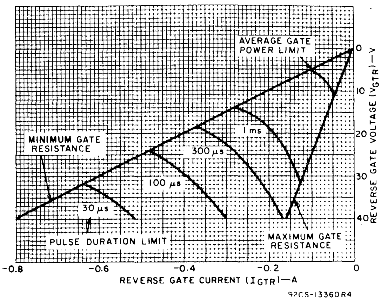


Fig.5 — Reverse bias gate-trigger characteristics.

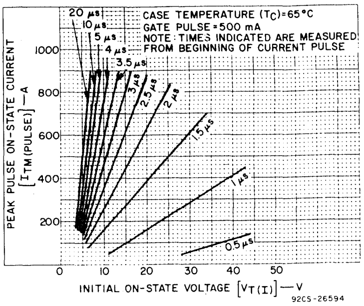


Fig.6 — Initial on-state voltage characteristics.

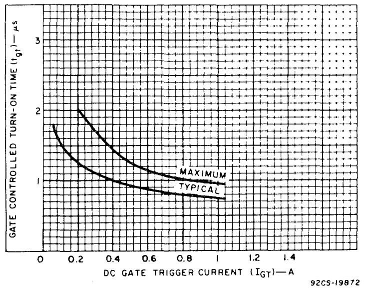


Fig.7 — Gate-controlled turn-on time vs. gate trigger current.

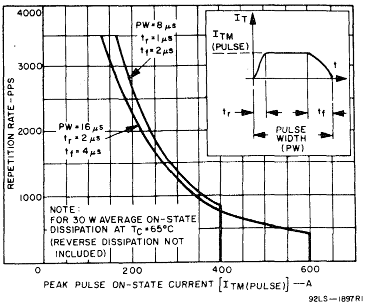


Fig.8 — Peak pulse on-state current as a function of repetition rate, rectangular pulse.

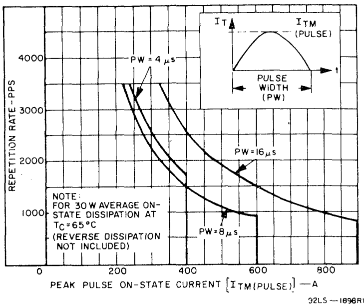


Fig.9 — Peak pulse on-state current as a function of repetition rate, half sine wave pulse.

S7310 Series

40-A Asymmetrical Silicon Controlled Rectifiers (ASCR)

For Induction Cooking Appliances, Pulse Modulators,
High-Frequency Inverters, Electronic Welders, and
Other Switching Applications Up to 40 kHz

The RCA-S7310-series types are asymmetrical silicon controlled rectifiers designed for high-frequency power-switching applications such as induction-cooking-appliance controls, inverters, electronic welders, switching regulators, and high-current pulse modulators. These types may be used at frequencies up to 40 kHz. They are supplied in the JEDEC TO-48 package.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	S7310B	S7310C	S7310D	S7310E	S7310M	
V_{RROM}▲			7			V
V_{DROM}▲	200	300	400	500	600	V
$I_{T(RMS)}$ (T_C = 75°C, θ = 180°)			40			A
$I_{T(AV)}$ (T_C = 75°C, θ = 180°)			25			A
I_{TSM}:						
For one full cycle of applied principal voltage						
60-Hz (sinusoidal)			400			A
50-Hz (sinusoidal)			370			A
For more than one cycle of applied principal voltage			*See Fig. 5*			
di/dt:						
V_{DM} = V_{DROM}, I_{GT} = 500 mA, t_r = 0.5 μs			2000			A/μs
I^2T (at T_C = 75°C):						
t = 10 ms			700			A^2s
t = 1 ms			325			A^2s
P_{GM}●:						
Peak forward for 10 μs max.			40			W
$P_{G(AV)}$●:						
Averaging time = 10 ms maximum			2			W
T_{stg}■			−40 to 150			°C
T_C■			−40 to 125			°C
T_T:						
During soldering for 10 s maximum (terminal and case)			225			°C
T_s:						
Recommended			35			in-lbf
			0.4			kgf-m
Maximum (DO NOT EXCEED)			50			in-lbf
			0.57			kgf-m

▲ These values do not apply if there is a positive gate signal. Gate must be open or negatively biased.

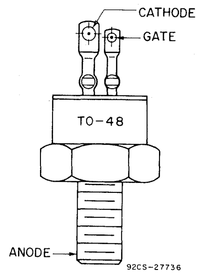
● Any product of gate current and gate voltage which results in a gate power less than the maximum is permitted.

■ For temperature measurement reference point, see Dimensional Outline.

Features:

- Fast turn-off-time-4μs max.
- High di/dt and dv/dt capabilities
- Shorted-emitter gate-cathode construction. . .contains an internally diffused resistor between gate and cathode
- Low thermal resistance
- Center-gate construction . . .provides rapid uniform gate-current spreading for faster turn-on with substantially reduced heating effects

TERMINAL DESIGNATIONS



JEDEC TO-48

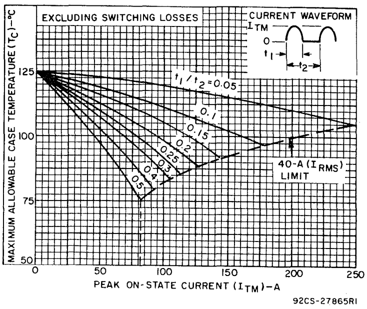


Fig. 1 — Maximum allowable case temperature vs. peak on-state current.

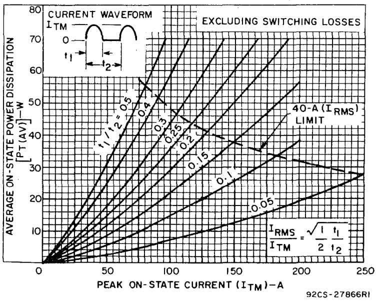


Fig. 2 — Average on-state power dissipation vs. peak on-state current.

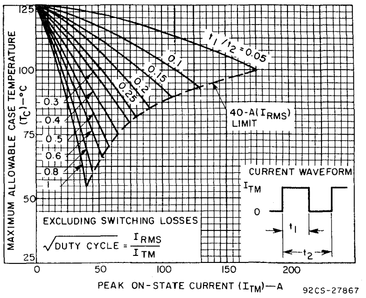


Fig. 3 — Maximum allowable case temperature vs. peak on-state current.

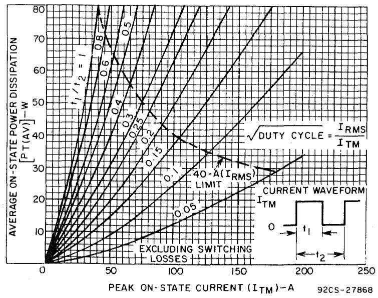


Fig. 4 — Average on-state power dissipation vs. peak on-state current.

S7310 Series

ELECTRICAL CHARACTERISTICS

As Maximum Ratings Unless Otherwise Specified and at Indicated Case Temperature (T_C)

CHARACTERISTIC	LIMITS			UNITS
	FOR ALL TYPES			
	Min.	Typ.	Max.	
I_{DROM}: $V_D = V_{DROM}$, $T_C = 125°C$	–	–	4	mA
I_{RROM}: $V_R = V_{RROM}$, $T_C = 125°C$	–	–	5	
V_T: $I_{TM} = 100$ A (peak), $T_C = 25°C$	–	1.7	2.5	V
$V_{T(I)}$: $I_{TM} = 100$ A (peak), $I_{GT} = 0.5$ A, $t_r = 0.1$ μs, $T_C = 25°C$ (measured 0.5 μs after 10% of I_{TM})	–	14	22	V
i_{HO}: $T_C = 25°C$	10	35	110	mA
dv/dt: (Linear) $V_D = V_{DROM}$, $T_C = 125°C$	250	550	–	V/μs
I_{GT}: $V_D = 12$ V dc, $R_L = 30\ \Omega$, $T_C = 25°C$	–	50	80	mA
V_{GT}: $V_D = 12$ V dc, $R_L = 30\ \Omega$, $T_C = 25°C$	–	1	3	V
t_{gt}: $V_D = V_{DROM}$, $i_T = 100$ A (peak), $I_{GT} = 500$ mA, $t_r = 0.1$ μs, $T_C = 25°C$, t_{gt}	–	250	290	ns
t_r	–	90	110	
t_d	–	160	180	
t_q: 1/2 Sine Wave $V_D = V_{DROM}$, $i_T = 100$ A, pulse duration = 2 μs, dv/dt = 200 V/μs, $I_{GT} = 500$ mA at turn-on, $V_{GK} = -10$ V at turn-off, $T_C = 115°C$	–	2.8	4	μs
R_{GK} (Reverse)	–	30	50	Ω
$R_{\theta JS}$	–	–	0.9	°C/W

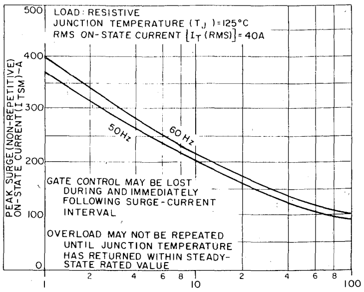


Fig. 5 — Peak surge on-state vs. surge duration.

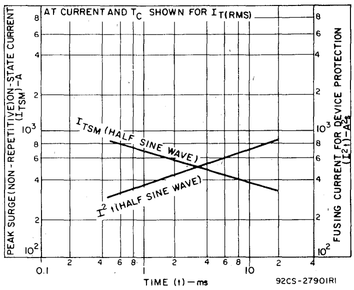


Fig. 6 — Peak surge on-state and fusing current vs. time.

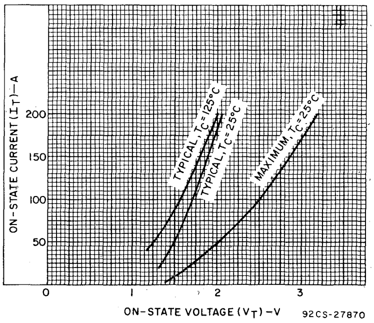


Fig. 7 — On-state current vs. on-state voltage.

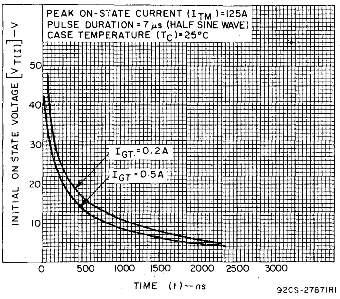


Fig. 8 — Typical initial on-state voltage vs. time. [Zero time is the time at which the initial on-state current is equal to 0.10I_{TM} (See Fig. 17)]

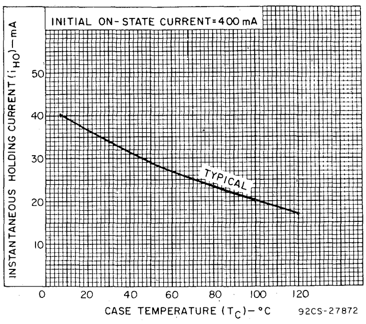


Fig. 9 — Typical instantaneous holding current vs. case temperature.

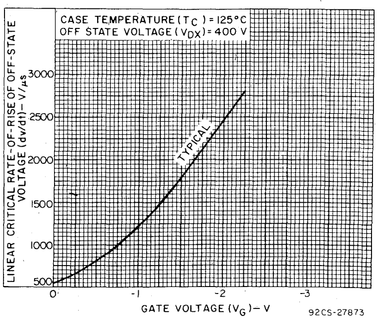


Fig. 10 — Typical linear critical rate of rise of off-state voltage vs. gate voltage.

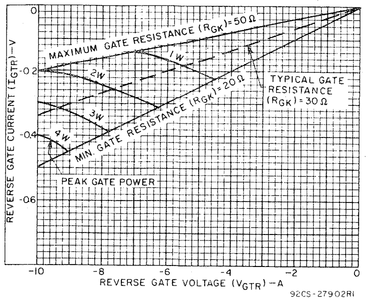


Fig. 11 – Reverse gate-trigger characteristics.

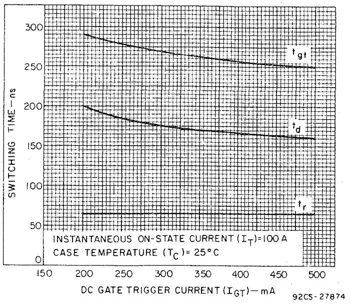


Fig. 12 – Typical switching time (t_{gt}, t_d, t_r) vs. gate-trigger current.

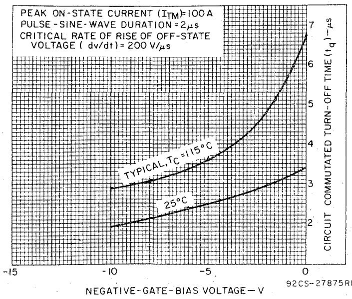


Fig. 13 – Typical circuit commutated turn-off time vs. gate-trigger voltage.

S7410 (2N3650-2N3653; S7410M) S7412 (2N3654-2N3658; S7412M) Series

35-A Silicon Controlled Rectifiers

For Inverter Applications

RCA-2N3650 to 2N3658, inclusive, and the S7410M* and S7412M● are all-diffused silicon controlled rectifiers (reverse-blocking triode thyristors) intended for high-speed switching applications such as power inverters, switching regulators, and high-current pulse applications. They feature fast turn-off, high dv/dt, and high di/dt characteristics and may be used at frequencies up to 25 kHz.

This SCR series has forward and reverse off-state voltage ratings of 50, 100, 200, 300, and 400 volts. Types S7410M and S7412M has a forward and reverse off-state voltage rating of 600 volts.

These SCR's employ a hermetic JEDEC TO-48 package.

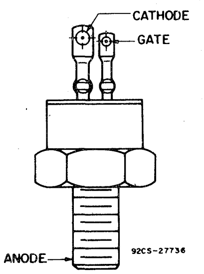
● Formerly RCA Type No. S7432M.

* Formerly RCA Type No. S7430M.

Features

- **Fast turn-off time — 10 μs to 15 μs max.**
- **High di/dt and dv/dt capabilities**
- **Shorted-emitter center gate design**
- **Low thermal resistance**

TERMINAL CONNECTIONS



JEDEC TO-48

MAXIMUM RATINGS, *Absolute-Maximum Values:*	**2N3654**	**2N3650** **2N3655**	**2N3651** **2N3656**	**2N3652** **2N3657**	**2N3653** **2N3658**	**S7410M** **S7412M**	
* V_{RSOM}▲	75	150	300	400	500	700	V
V_{DSOM}▲	75	150	300	400	500	700	V
* V_{RROM}▲	50	100	200	300	400	600	V
* V_{DROM}▲	50	100	200	300	400	600	V
$I_{T(RMS)}$ (T_C = 40°C, θ = 180°)	35						A
* $I_{T(AV)}$ (T_C = 40°C, θ = 180°)	25						A
* I_{TSM}: Peak rectangular pulse, t_p = 5 ms, t_r = 50 μs max.	180						A
* di/dt: $V_D = V_{DROM}$, I_{GT} = 200 mA, t_r = 0.1 μs	400						A/μs
I^2t: T_J = −65 to 120°C, t = 1 tď 8.3 ms	165						A^2s
* P_{GM}●: Peak (forward or reverse) for 10 μs maximum, See Fig. 6)	40						W
* $P_{G(AV)}$●: Averaging time = 10 ms maximum	1						W
* T_{stg}■	−65 to 150						°C
* T_C■	−65 to 120						°C
T_T: During soldering for 10 s maximum (terminal and case)	225						°C
τ_s: Recommended	35						in-lbf
	0.4						kgf-m
Maximum (DO NOT EXCEED)	50						in-lbf
	0.57						kgf-m

* In accordance with JEDEC registration data format (JS-14, RDF-1) filed for the JEDEC (2N series) types.

▲ These values do not apply if there is a positive gate signal. Gate must be open or negatively biased.

● Any product of gate current and gate voltage which results in a gate power less than the maximum is permitted.

■ For temperature measurement reference point, see Dimensional Outline.

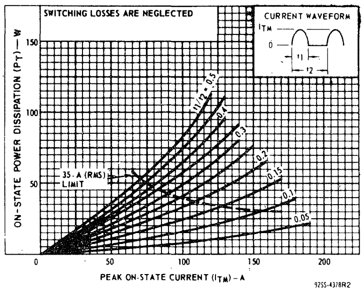


Fig. 1 - Maximum allowable case temperature as a function of on-state current.

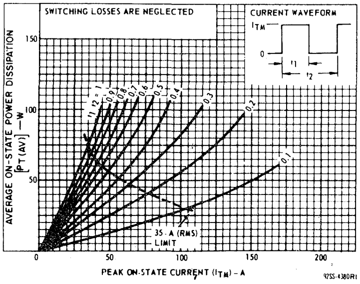


Fig. 2 - Maximum allowable case temperature as a function of on-state current.

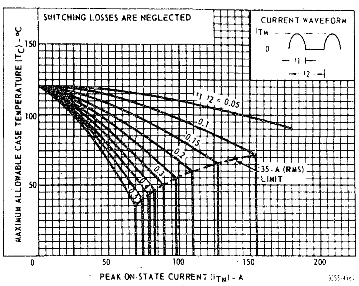


Fig. 3 - Peak surge on-state current as a function of surge duration.

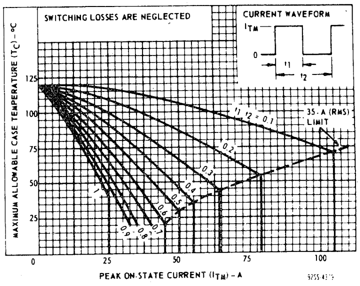


Fig. 4 - Peak surge on-state current as a function of surge duration.

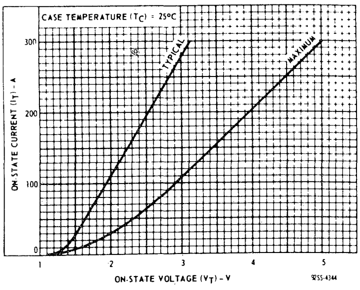


Fig. 5 - Maximum allowable case-temperature as a function of peak on-state current.

S7410 (2N3650-2N3653; S7410M) S7412 (2N3654-2N3658; S7412M) Series

ELECTRICAL CHARACTERISTICS

At Maximum Ratings Unless Otherwise Specified and at Indicated Case Temperature (T_C)

CHARACTERISTIC	LIMITS			UNITS
	FOR ALL TYPES Except as Specified			
	MIN.	TYP.	MAX.	
I_{DOM} or I_{ROM}: $V_D = V_{DROM}$ or $V_R = V_{RROM}$, $T_C = 120°C$				
2N3654, 2N3655, 2N3656, S7412M	–	2	6*	mA
2N3657	–	2	5.5*	mA
2N3658	–	2	4*	mA
v_T: $i_T = 25$ A (peak), $T_C = 25°C$	–	1.5	2.05*	V
i_{HO}:				
$T_C = 25°C$	–	75	150	mA
$T_C = -65°C$	–	150	350*	mA
* dv/dt: $V_D = V_{DROM}$, exponential voltage rise, $T_C = 120°C$	200	–	–	V/µs
I_{GT}:				
$V_D = 6$ V (dc), $R_L = 4\ \Omega$, $T_C = 25°C$	–	80	180	mA
$V_D = 6$ V (dc), $R_L = 2\ \Omega$, $T_C = -65°C$	–	150	500*	mA
V_{GT}:				
$V_D = 6$ V (dc), $R_L = 4\ \Omega$, $T_C = 25°C$	–	1.5	3	V
* $V_D = 6$ V (dc), $R_L = 200\ \Omega$, $T_C = 120°C$	0.25	–	–	V
$V_D = 6$ V (dc), $R_L = 2\ \Omega$, $T_C = -65°C$	–	2	4.5*	V
* tq:				
Rectangular Pulse: $V_{DX} = V_{DROM}$, $i_T = 10$ A, pulse duration = 50 µs, dv/dt = 200 V/µs, –di/dt = 5 A/µs, $I_{GT} = 200$ mA at turn-on, $V_{RX} = 15$ V minimum, $V_{GK} = 0$ V at turn-off, $T_C = 120°C$	–	–	15	µs
Sinusoidal Pulse: $V_{DX} = V_{DROM}$, $i_T = 100$ A, pulse duration = 2 µs, dv/dt = 200 V/µs, $V_{RX} = 30$ V minimum, $V_{GK} = 0$ at turn-off, $T_C = 115°C$	–	–	15	µs
$R_{\theta JC}$	–	0.85	1.7*	°C/W

* In accordance with JEDEC registration data format (JS-14, RDF-1) filed for the JEDEC (2N series) types.

▲ These values do not apply if there is a positive gate signal. Gate must be open or negatively biased.

● Any product of gate current and gate voltage which results in a gate power less than the maximum is permitted.

■ For temperature measurement reference point, see Dimensional Outline.

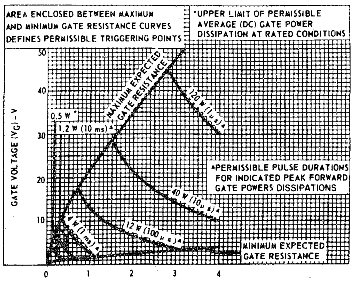


Fig.6 – Typical forward-biased gate characteristics.

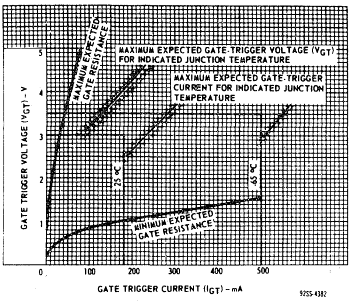


Fig.7 – Typical gate-trigger characteristics.

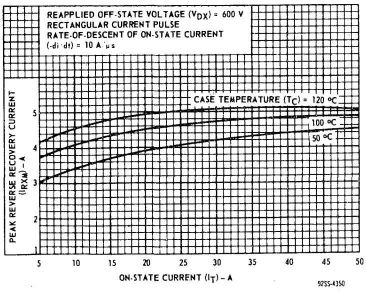


Fig.8 – Typical variation of peak reverse-recovery current with on-state current (rectangular pulse).

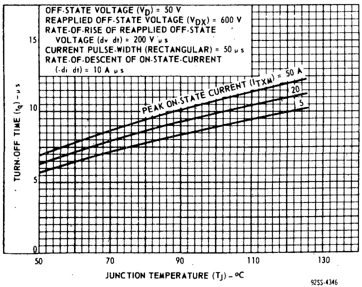


Fig.9 – Typical variation of turn-off time with junction temperature (rectangular pulse).

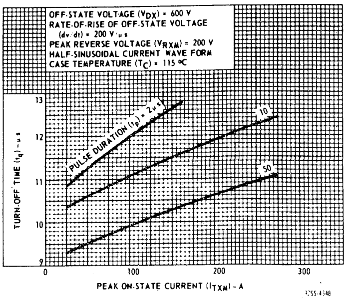


Fig.10 – Typical variation of turn-off time with peak on-state current (half-sine-wave pulse).

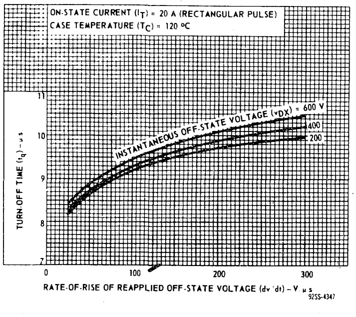


Fig.11 – Typical variation of turn-off time with rate-of-rise of reapplied off-state voltage (rectangular pulse).

Gate-Turn-off (GTO) Silicon Controlled Rectifiers

Technical Data

G5001,G5002,G5003 Series
8.5-A Gate-Turn-Off (GTO) Silicon Controlled Rectifiers

For High-, Medium-, and Low-Frequency Power-Switching Applications

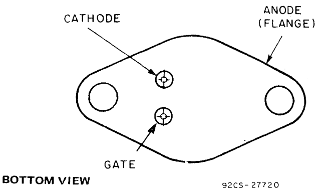
The RCA-G5001, G5002, and G5003 series devices are gate-turn-off silicon controlled rectifiers (GTO's). GTO devices employ the same basic four-layer, three-junction regenerative semiconductor structure and exhibit a pulse turn-on capability similar to that of conventional silicon controlled rectifiers (SCR's). GTO devices, however, differ from conventional SCR's in that they can be turned off by application of a negative voltage to the gate terminal.

The G5001, G5002, and G5003 series gate-turn-off SCR's employ the popular JEDEC TO-3 hermetic package. The three series of devices differ in their gate-controlled turn-on and turn-off capabilities and peak reverse gate-voltage ratings. The types in each series differ in their off-state voltage ratings. The suffix letter indicates the voltage (V_{DRXM}) rating for each type.

Features:

- **Turn-off capability at gate terminal**
- **Operating temperature range to 125°C**

TERMINAL DESIGNATIONS



JEDEC TO-3

MAXIMUM RATINGS, *Absolute-Maximum Values:*	G5001A G5002A G5003A	G5001B G5002B G5003B	G5001C G5002C G5003C	G5001D G5002D G5003D	G5001E G5002E G5003E	G5001M G5002M G5003M	
V_{RROM}	50	50	50	50	50	50	V
V_{DRXM}:							
R_{GK} = 1000 Ω	100	200	300	400	500	600	V
V_{GRRM}:							
G5001 series	70						V
G5002 series	70						V
G5003 series	50						V
I_{TGQM}	15						A
I_T (T_C = 75°C)	8.5						A
I_{TSM}: For one full cycle of applied principal voltage							
60 Hz (sinusoidal), T_C = 75°C.	50						A
50 Hz (sinusoidal), T_C = 75°C.	40						A
I^2t:							
T_J = –40 to 125°C, t = 1 to 8.3 ms.	10						A^2s
P_D (T_C = 25°C).	50						W
I_{GM}	3						A
P_{GRM}	25						W
T_{stg}▲	–40 to 150						°C
T_C▲	–40 to 125						°C
T_L: At distances ⩾ 1/32 in. (0.8 mm) from seating plane for 10 s max.	250						°C

▲ For temperature measurement reference point, see Dimensional Outline.

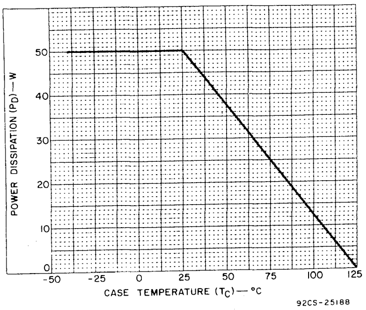


Fig. 1 — Dissipation vs. case temperature.

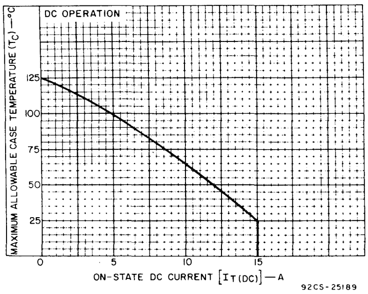


Fig. 2 — Maximum allowable case temperature vs. on-state dc current.

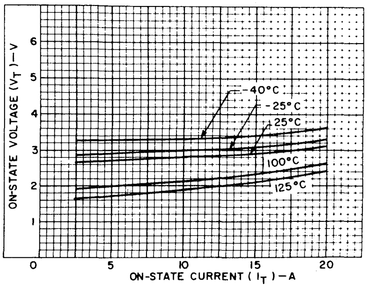


Fig. 3 — Maximum on-state voltage vs. maximum on-state current.

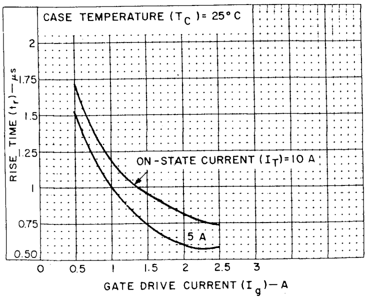


Fig. 4 — Rise time vs. gate-drive current.

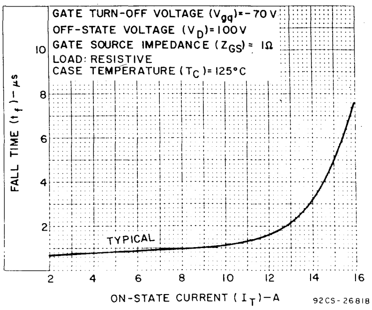


Fig. 5 — Fall time vs. on-state current for G5001 series.

G5001,G5002,G5003 Series

ELECTRICAL CHARACTERISTICS

At Maximum Ratings and $T_C = 25^{\circ}C$ Unless Otherwise Specified

CHARACTERISTIC	LIMITS			UNITS
	FOR ALL TYPES UNLESS OTHERWISE SPECIFIED			
	MIN.	TYP.	MAX.	
I_{DRXM}: $V_D = V_{DRXM}$, $R_{GK} = 1000\ \Omega$, $T_C = 125^{\circ}C$	–	–	2	mA
I_{RROM}: $V_R = V_{RROM}$, $T_C = 125^{\circ}C$	–	–	2	
I_{GRRM}: $V_{GR} = V_{GRRM}$	–	–	300	µA
V_T: For $I_T = 5$ A, $T_J = 100^{\circ}C$	–	1.5	2	V
For other conditions	← See Fig. 3 →			
I_{GT}: $V_D = 12$ V (dc), $R_L = 6.5\ \Omega$, $T_C = 25^{\circ}C$	–	–	160	mA
V_{GT}: $V_D = 12$ V (dc), $R_L = 6.5\ \Omega$, $T_C = 25^{\circ}C$	–	–	2.5	V
I_L: $V_D = 40$ V, $I_G = 200$ mA, $tp = 50\ \mu s$	–	500	800	mA
dv/dt: $V_D = V_{DRXM}$ value, $V_G = -5$ V, Exponential rise, $T_C = 125^{\circ}C$	500	–	–	V/µs
t_{gt} (t_{ON}): $t_{gt} = t_d + t_r$ $V_D = 100$ V, $I_T = 5$ A, $I_g = 1$ A G5001 series	–	–	$t_d = 1$ $t_r = 1$	µs
G5002 series	–	–	$t_d = 1$ $t_r = 2$	
G5003 series	–	–	$t_d = 1$ $t_r = 2$	
t_{gq} (t_{OFF}): $t_{gq} = t_s + t_f$ $V_D = 100$ V for all "A" types, 200 V for all "B","C","D","E", and"M" types, $I_T = 5$ A, $Z_{GS} = 1\ \Omega$, resistive load, $T_C = 125^{\circ}C$: G5001 series ($V_{gq} = -70$ V)			$t_s = 1$ $t_f = 1$	µs
G5002 series ($V_{gq} = -70$ V)			$t_s = 1.5$ $t_f = 2$	
G5003 series ($V_{gq} = -50$ V)			$t_s = 5$ $t_f = 5$	
$R_{\theta JC}$▲	–	–	2	°C/W

▲ For temperature measurement reference point, see Dimensional Outline.

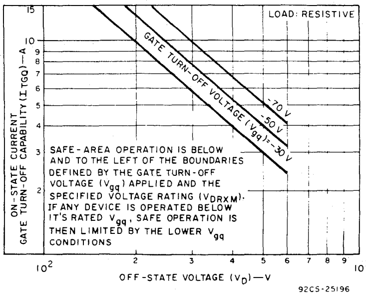


Fig. 6 — On-state current gate turn-off capability vs. off-state voltage.

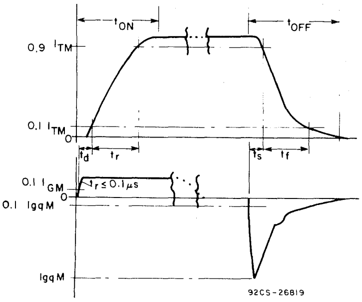


Fig. 7 — Relationship between anode current (on-state), gate-drive current, and time showing reference points for definition of t_{gt} (t_{ON}) and t_{gq} (t_{OFF}).

Diacs

Technical Data

D3202Y, D3202U

Silicon Bidirectional Diacs

Plastic-Packaged Two-Terminal Trigger Devices for
Applications in Military, Industrial, and Commercial Equipment

Features:

- **For critical triggering applications requiring narrow breakover voltage range (29-35V)—D3202Y**
- **Typical breakover voltage: $V_{(BO)}$ = 32 V**
- **Low breakover current (at breakover voltage): $I_{(BO)}$ = 25 μA max.**
- **High peak pulse current capability**
- **Breakover voltage symmetry:**
  $|+V_{(BO)}|-|-V_{(BO)}|$ = ±3 V max.

RCA D3202Y (45411)* and D3202U (45412)* are all-diffused, three-layer, two-terminal devices in an axial-lead plastic package designed specifically for triggering thyristors. Both units exhibit bidirectional negative-resistance characteristics.

These diacs are intended for use in thyristor phase-control circuits for lamp-dimming, universal-motor speed control, and heat controls. Their small size and plastic package of high insulation resistance make these diacs especially suitable for applications in which high packing densities are employed.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

DEVICE DISSIPATION:
At case temperature up to 40°C . . . . 1 W
At case temperatures above 40°C . . . Derate 0.016 W/°C

TEMPERATURE RANGE:
Storage . . . . −40 to +150 °C
Operating (Junction) . . . . −40 to +100 °C

LEAD TEMPERATURE (During Soldering)
At distance $\geq$ 1/16 in. (1.59 mm) from case
for 10 s max. . . . . 240 °C

---

*Number in parentheses is a former RCA type number.

ELECTRICAL CHARACTERISTICS: At Case Temperature (T_C) = 25°C

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	LIMITS				UNITS
			D3202Y		D3202U		
			MIN.	MAX.	MIN.	MAX.	
Breakover Voltage (Forward or Reverse)	$V_{(BO)}$		29	35	25	40	V
Breakover Voltage Symmetry	$\|+V_{(BO)}\|-\|-V_{(BO)}\|$		–	±3	–	±3	V
Peak Output Current	i_{pk}	V_{SUPPLY} = 30 V_{RMS}, C_T = 0.1 μF, R_L = 20 Ω	190	–	190	–	mA
Peak Breakover Current	$I_{(BO)}$	At breakover voltage	–	25	–	25	μA
Dynamic Breakback Voltage	$\|\Delta V\pm\|$	V_{SUPPLY} = 30 V_{RMS}, C_T = 0.1 μF R_L = 20 Ω	9	–	9	–	V
Thermal Impedance Junction-to-ambient	$I_{\theta JA}$		–	60	–	60	°C/W

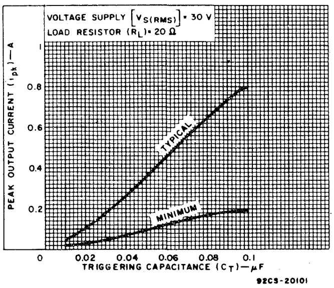


Fig.1 — Peak output current vs. triggering capacitance.

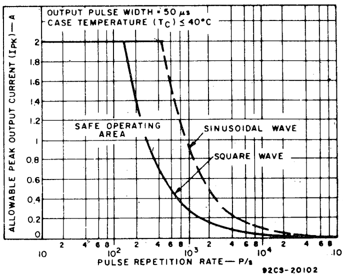


Fig.2 — Peak output-current derating curves.

Rectifiers and Rectifier Assemblies

Technical Data

Rectifiers

RCA TYPE	Forward Current Av. I_o A	Surge I_{FSM} A	Temp.-T_A °C	Package	Voltage V_{RRM} V	Temp. Range Operating °C	Voltage Drop V_F V	I_o A
STANDARD RECTIFIERS with Lead-Type Packages								
D11 types								
1N440B	0.75	15	50	DO-1	100	-65 to 165	1.5	■
1N441B	0.75	15	50		200	-65 to 165	1.5	■
1N442B	0.75	15	50		300	-65 to 165	1.5	■
1N443B	0.75	15	50		400	-65 to 165	1.5	■
1N444B	0.65	15	50		500	-65 to 150	1.5	■
1N445B	0.65	15	50		600	-65 to 150	1.5	■
1N536	0.75	15	50	DO-1	50	-65 to 165	1.1	0.5
1N537	0.75	15	50		100	-65 to 165	1.1	0.5
1N538	0.75	15	50		200	-65 to -165	1.1	0.5
1N539	0.75	15	50		300	-65 to 165	1.1	0.5
1N540	0.75	15	50		400	-65 to 165	1.1	0.5
1N1095	0.75	15	50		500	-65 to 165	1.2	0.5
1N547	0.75	15	50		600	-65 to 165	1.2	0.5
1N1763A	1	35	75	DO-1	400	-65 to 135	1.2	1
1N1764A	1	35	75		500	-65 to 135	1.2	1
1N2858A	1	35	75	DO-1	50	-65 to 135	1.2	1
1N2859A	1	35	75		100	-65 to 135	1.2	1
1N2860A	1	35	75		200	-65 to 135	1.2	1
1N2861A	1	35	75		300	-65 to 135	1.2	1
1N2862A	1	35	75		400	-65 to 135	1.2	1
1N2863A	1	35	75		500	-65 to 135	1.2	1
1N2864A	1	35	75		600	-65 to 135	1.2	1
D12 Types								
D1201F	1	30	75	DO-15	50	-65 to 175	1.1	1
D1201A	1	30	75		100	-65 to 175	1.1	1
D1201B	1	30	75		200	-65 to 175	1.1	1
D1201D	1	30	75		300	-65 to 175	1.1	1
D1201M	1	30	75		400	-65 to 175	1.1	1
D1201N	1	30	75		800	-65 to 175	1.1	1
D1201P	1	30	75		1000	-65 to 175	1.1	1
1N5391	1.5	50	70	DO-15	50	-65 to 170	1.4	1.5
1N5392	1.5	50	70		100	-65 to 170	1.4	1.5
1N5393	1.5	50	70		200	-65 to 170	1.4	1.5
1N5394	1.5	50	70		300	-65 to 170	1.4	1.5
1N5395	1.5	50	70		400	-65 to 170	1.4	1.5
1N5396	1.5	50	70		500	-65 to 170	1.4	1.5
1N5397	1.5	50	70		600	-65 to 170	1.4	1.5
1N5398	1.5	50	70		800	-65 to 170	1.4	1.5
1N5399	1.5	50	70		1000	-65 to 170	1.4	1.5
D13 types								
D1300A	0.25	30	65	TO-1 (2-Lead)	100	-65 to 125	1	0.25
D1300B	0.25	30	65		200	-65 to 125	1	0.25
D1300D	0.25	30	65		400	-65 to 125	1	0.25
D16 types								
1N3193	0.75	35	75	DO-26	200	-65 to 100	1.2	0.5
1N3194	0.75	35	75		400	-65 to 100	1.2	0.5
1N3195	0.75	35	75		600	-65 to 100	1.2	0.5
1N3196	0.5	35	75		800	-65 to 100	1.2	0.5

■ At full load current

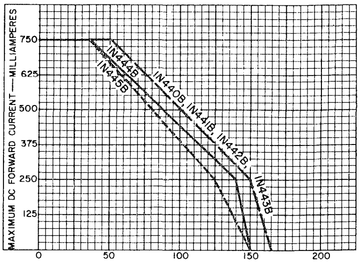


Fig. 1 — Maximum average forward current vs. ambient temperature for 1N440B–1N445B.

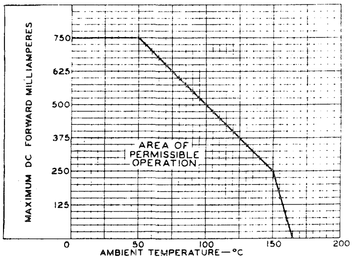


Fig. 2 — Maximum average forward current vs. ambient temperature for 1N536–1N540, 1N547, and 1N1095.

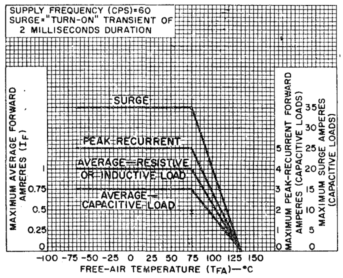


Fig. 3 — Maximum average forward current/ peak recurrent/surge current vs. ambient temperature for 1N1763A, 1N1764A, and 1N2858A–1N2864A.

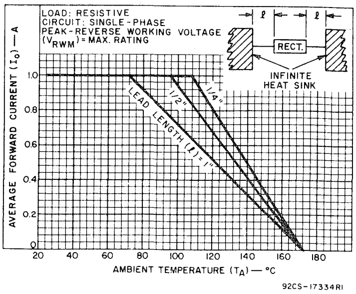


Fig. 4 — Maximum average forward current vs. ambient temperature for D1201 series.

	Forward Current			Package	Voltage	Temp. Range	Voltage Drop	
RCA TYPE	Av. I_o A	Surge I_{FSM} A	Temp.-T_A °C		V_{RRM} V	Operating °C	V_F V	I_o A

STANDARD RECTIFIERS with Lead-Type Packages (continued)

D16 types (cont'd)

1N5211	1	50	75	DO-26	200	-65 to 175	1.2	1
1N5212	1	50	75		400	-65 to 175	1.2	1
1N5213	1	50	75		600	-65 to 175	1.2	1
1N5214	0.75	50	75		800	-65 to 175	1.2	1

D17 types

1N3253	0.75	35	75	DO-26	200	-65 to 100	1.2	0.5
1N3254	0.75	35	75		400	-65 to 100	1.2	0.5
1N3255	0.75	35	75		600	-65 to 100	1.2	0.5
1N3256	0.5	35	75		800	-65 to 100	1.2	0.5
1N3563	0.4	35	75		1000	-65 to 100	1.2	0.5

1N5215	1	50	75	DO-26	200	-65 to 175	1.2	1
1N5216	1	50	75		400	-65 to 175	1.2	1
1N5217	1	50	75		600	-65 to 175	1.2	1
1N5218	0.75	50	75		800	-65 to 175	1.2	1

STANDARD RECTIFIERS with Stud-Type Packages‡

D14 types

1N1341B	6	160	150	DO-4	50	-65 to 200	0.65■	6
1N1342B	6	160	150		100	-65 to 200	0.65■	6
1N1344B	6	160	150		200	-65 to 200	0.65■	6
1N1345B	6	160	150		300	-65 to 200	0.65■	6
1N1346B	6	160	150		400	-65 to 200	0.65■	6
1N1347B	6	160	150		500	-65 to 200	0.65■	6
1N1348B	6	160	150		600	-65 to 200	0.65■	6

1N1199A	12	240	150	DO-4	50	-65 to 200	0.55■	12
1N1200A	12	240	150		100	-65 to 200	0.55■	12
1N1202A	12	240	150		200	-65 to 200	0.55■	12
1N1203A	12	240	150		300	-65 to 200	0.55■	12
1N1204A	12	240	150		400	-65 to 200	0.55■	12
1N1205A	12	240	150		500	-65 to 200	0.55■	12
1N1206A	12	240	150		600	-65 to 200	0.55■	12

D15 types

1N248C	20	350	150	DO-5	50	-65 to 175	0.6■	20
1N249C	20	350	150		100	-65 to 175	0.6■	20
1N250C	20	350	150		200	-65 to 175	0.6■	20
1N1195A	20	350	150		300	-65 to 175	0.6■	20
1N1196A	20	350	150		400	-65 to 175	0.6■	20
1N1197A	20	350	150		500	-65 to 175	0.6■	20
1N1198A	20	350	150		600	-65 to 175	0.6■	20

1N1183A	40	800	150	DO-5	50	-65 to 200	0.65■	40
1N1184A	40	800	150		100	-65 to 200	0.65■	40
1N1186A	40	800	150		200	-65 to 200	0.65■	40
1N1187A	40	800	150		300	-65 to 200	0.65■	40
1N1188A	40	800	150		400	-65 to 200	0.65■	40
1N1189A	40	800	150		500	-65 to 200	0.65■	40
1N1190A	40	800	150		600	-65 to 200	0.65■	40

‡ Reverse-polarity versions available

■ At full cycle average

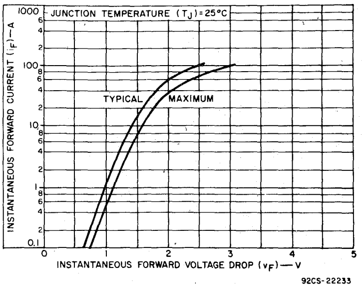


Fig. 5 — Forward current vs. forward voltage drop for D2406 series.

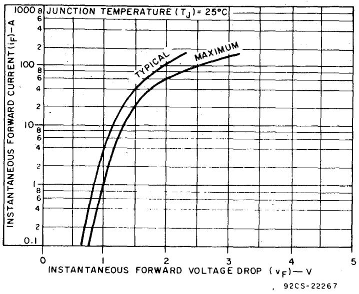


Fig. 6 — Forward current vs. forward voltage drop for D2412 series.

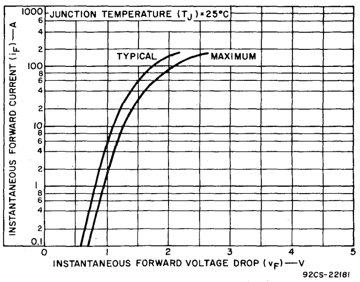


Fig. 7 — Forward current vs. forward voltage drop for D2520 series.

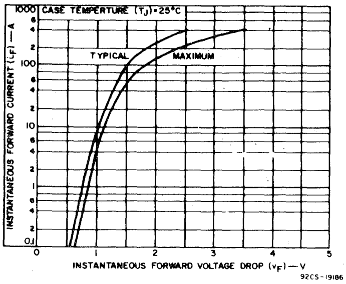
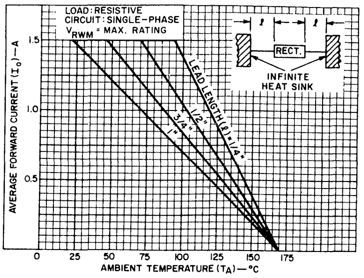


Fig. 8 — Forward current as a function of forward voltage drop for D2540 series.



92CS-17312

Fig. 9 — Average-forward-current vs. ambient temperature for 1N5391–1N5399 for several lead lengths.

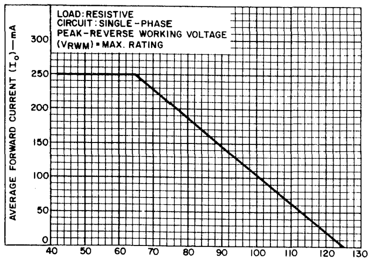


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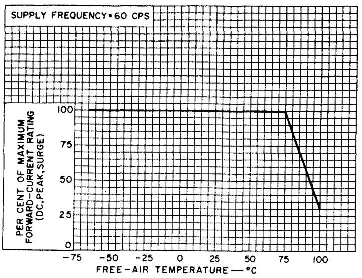
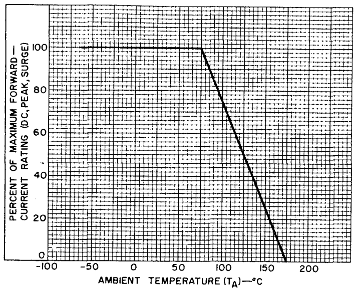
Fig. 10 — Maximum average-forward-current vs. ambient temperature for D1300 series.



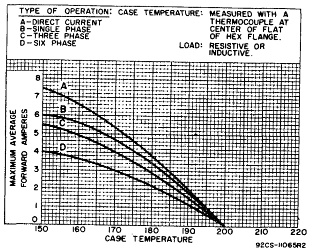
92CS-9727R2

Fig. 11 — Maximum average forward current/ peak recurrent/surge current vs. ambient temperature for 1N3193–1N3196, 1N3253–1N3256, and 1N3563.



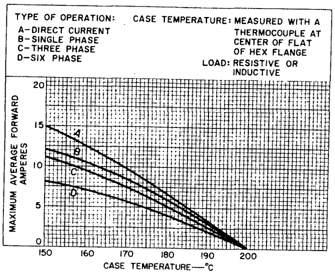
92CS-14455

Fig. 12 — Maximum average forward/peak recurrent/surge current vs. ambient temperature for 1N5211–1N5218.



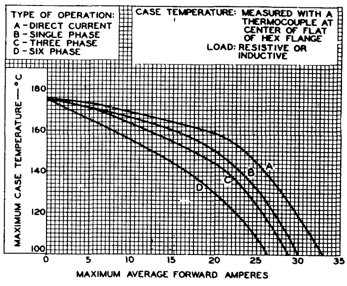
92CS-11065R2

Fig. 13 — Maximum average forward current vs. case temperature for 1N1341B, 1N1342B, 1N1344B–1N1348B.



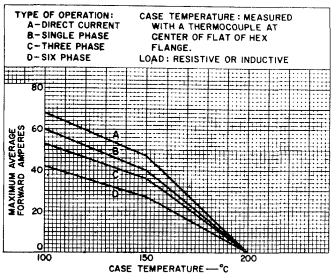
92CS-11065R1

Fig. 14 — Maximum average forward current vs. case temperature for 1N1199A, 1N1200A, 1N1202A–1N1206A.



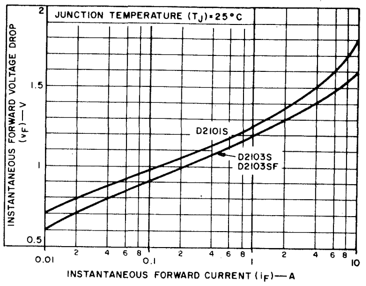
92CS-10746

Fig. 15 — Maximum average forward current vs. case temperature for 1N248C, 1N250C, 1N1195A–1198A.



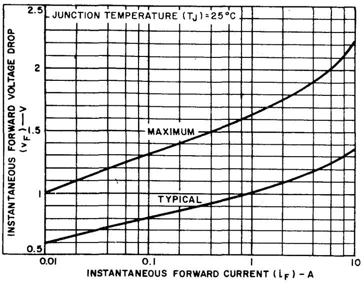
92CS-11342R1

Fig. 16 — Maximum average forward current vs. case temperature for 1N1183A, 1N1184A, 1N1186A–1N1190A.



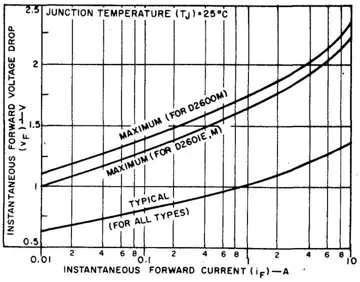
92CS-24049

Fig. 17 — Forward-voltage drop vs. forward current for D2101S, D2103S, and D2103SF.



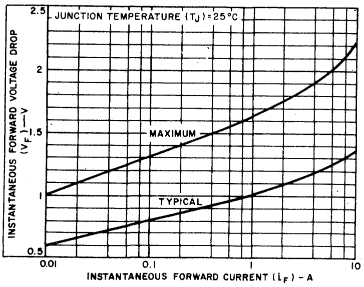
92CS-17520

Fig. 18 — Forward voltage drop vs. forward current for D2201 series.



92CS-24986

Fig. 19 — Forward-voltage drop vs. forward current for D2600M, D2601E, and D2601M.



92CS-17520

Fig. 20 — Forward-voltage drop vs. forward current for D2601 series.

	Forward Current											
	RMS	Av.	Surge		Package	Voltage	Temp. Range	Voltage Drop		Rev. Recovery Time		
RCA TYPE	$I_{F(RMS)}$ A	I_o A	I_{FSM} A	Temp.-T_A °C		V_{RRM} V	Operating °C	v_F V	i_F A	t_{rr} µs	I_{FM} A	T_C °C

FAST-RECOVERY RECTIFIERS with Lead-Type Packages

D21 types

D2103SF	3	–	70	150●●	DO-1	750	-30 to 150	1.4	4	0.5	3.14	25
D2103S	3	–	70	150●●		700	-30 to 150	1.4	4	0.5	3.14	25
D2101S	1	–	30	45		700	-30 to 80	1.5	4	0.7	3.14	25

●● Junction Temperature

D22 types

D2201F	1.5	1	50●	100■	DO-15	50	-40 to 150	1.9	4	0.5	3.14	25
D2201A	1.5	1	50●	100■		100	-40 to 150	1.9	4	0.5	3.14	25
D2201B	1.5	1	50●	100■		200	-40 to 150	1.9	4	0.5	3.14	25
D2201D	1.5	1	50●	100■		400	-40 to 150	1.9	4	0.5	3.14	25
D2201E	1.5	1	50●	100■		500	-40 to 150	1.9	4	0.5	3.14	25
D2201M	1.5	1	50●	100■		600	-40 to 150	1.9	4	0.5	3.14	25
D2201N	1.5	1	50●	100■		800	-40 to 150	1.9	4	0.5	3.14	25

● At Junction Temperature (T_J) = 150 °C

■ Lead Temperature

D26 types

D2600M	0.5	–	30	45	DO-26	600	-40 to 80	2	4	0.7	20	25
D2601E	1.6	–	70	150●		500	-40 to 150	1.9	4	0.5	20	25
D2601M	1.9	–	70	150●		600	-40 to 150	1.9	4	0.5	20	25

D2601F	1.5	1	35♠	100■	DO-26	50	-40 to 150	1.9	4	0.5	20	25
D2601A	1.5	1	35♠	100■		100	-40 to 150	1.9	4	0.5	20	25

D2601B	1.5	1	35♠	100■	DO-26	200	-40 to 150	1.9	4	0.5	20	25
D2601D	1.5	1	35♠	100■		400	-40 to 150	1.9	4	0.5	20	25
D2601M	1.5	1	35♠	100■		600	-40 to 150	1.9	4	0.5	20	25
D2601N	1.5	1	35♠	100■		800	-40 to 150	1.9	4	0.5	20	25

FAST-RECOVERY RECTIFIERS with Stud Packages ‡

D24 types

D2406F	9	6	125	100	DO-4	50	-40 to 150	1.4	6	0.35	19	25
D2406A	9	6	125	100		100	-40 to 150	1.4	6	0.35	19	25
D2406B	9	6	125	100		200	-40 to 150	1.4	6	0.35	19	25
D2406C	9	6	125	100		300	-40 to 150	1.4	6	0.35	19	25
D2406D	9	6	125	100		400	-40 to 150	1.4	6	0.35	19	25
D2406M	9	6	125	100		600	-40 to 150	1.4	6	0.35	19	25
1N3879	9	6	75	100		50	-65 to 150	1.4	6	0.20	1	25
1N3880	9	6	75	100		100	-65 to 150	1.4	6	0.20	1	25
1N3881	9	6	75	100		200	-65 to 150	1.4	6	0.20	1	25
1N3882	9	6	75	100		300	-65 to 150	1.4	6	0.20	1	25
1N3883	9	6	75	100		400	-65 to 150	1.4	6	0.20	1	25

D2412F	18	12	250	100	DO-4	50	-40 to 150	1.4	12	0.35	38	25
D2412A	18	12	250	100		100	-40 to 150	1.4	12	0.35	38	25
D2412B	18	12	250	100		200	-40 to 150	1.4	12	0.35	38	25
D2412C	18	12	250	100		300	-40 to 150	1.4	12	0.35	38	35
D2412D	18	12	250	100		400	-40 to 150	1.4	12	0.35	38	25
D2412M	18	12	250	100		600	-40 to 150	1.4	12	0.35	38	25
1N3889	18	12	150	100		50	-65 to 150	1.4	12	0.20	1	25
1N3890	18	12	150	100		100	-65 to 150	1.4	12	0.20	1	25
1N3891	18	12	150	100		200	-65 to 150	1.4	12	0.20	1	25
1N3892	18	12	150	100		300	-65 to 150	1.4	12	0.20	1	25
1N3893	18	12	150	100		400	-65 to 150	1.4	12	0.20	1	25

♠ At Junction Temperature (T_J) = 165 °C

■ Lead Temperature

● Junction Temperature

‡ Reverse-polarity versions available

Rectifiers

RCA TYPE	Forward Current RMS $I_{F(RMS)}$ A	Av. I_o A	Surge I_{FSM} A	Temp.-T_C °C	Package	Voltage V_{RRM} V	Temp. Range Operating °C	Voltage Drop v_F V	i_F A	Rev. Recovery Time t_{rr} µs	I_{FM} A	T_C °C

FAST-RECOVERY RECTIFIERS with Stud Packages (cont'd)

D25 types

RCA TYPE	$I_{F(RMS)}$ A	I_o A	I_{FSM} A	Temp.-T_C °C	Package	V_{RRM} V	Operating °C	v_F V	i_F A	t_{rr} µs	I_{FM} A	T_C °C
D2520F	30	20	300	100	DO-5	50	-40 to 150	1.4	20	0.35	63	25
D2520A	30	20	300	100		100	-40 to 150	1.4	20	0.35	63	25
D2520B	30	20	300	100		200	-40 to 150	1.4	20	0.35	63	25
D2520C	30	20	300	100		300	-40 to 150	1.4	20	0.35	63	25
D2520D	30	20	300	100		400	-40 to 150	1.4	20	0.35	63	25
D2520M	30	20	300	100		600	-40 to 150	1.4	20	0.35	63	25
1N3899	30	20	225	100		50	-65 to 150	1.4	20	0.20	1	25
1N3900	30	20	225	100		100	-65 to 150	1.4	20	0.20	1	25
1N3901	30	20	225	100		200	-65 to 150	1.4	20	0.20	1	25
1N3902	30	20	225	100		300	-65 to 150	1.4	20	0.20	1	25
1N3903	30	20	225	100		400	-65 to 150	1.4	20	0.20	1	25
1N3909	45	30	300	100	DO-5	50	-65 to 150	1.4	30	0.20	1	25
1N3910	45	30	300	100		100	-65 to 150	1.4	30	0.20	1	25
1N3911	45	30	300	100		200	-65 to 150	1.4	30	0.20	1	25
1N3912	45	30	300	100		300	-65 to 150	1.4	30	0.20	1	25
1N3913	45	30	300	100		400	-65 to 150	1.4	30	0.20	1	25
D2540F	60	40	700	165	DO-5	50	-40 to 150	1.8	100	0.35	125	25
D2540A	60	40	700	165		100	-40 to 150	1.8	100	0.35	125	25
D2540B	60	40	700	165		200	-40 to 150	1.8	100	0.35	125	25
D2540D	60	40	700	165		400	-40 to 150	1.8	100	0.35	125	25
D2540M	60	40	700	165		600	-40 to 150	1.8	100	0.35	125	25

‡ Reverse-polarity versions available

Bridge Rectifiers

CR401 SERIES ♦

Fin-mounted, single-phase, full-wave types.

RCA Type No.	Average DC Output Current (A)	Average DC Output Voltage (V)	RMS Supply Voltage (V)
CR401	18	200	222
CR402	18	400	444
CR403	18	800	888
CR404	34	200	222
CR405	34	400	444
CR406	34	800	888
CR407	70	200	222
CR408	70	400	444
CR409	70	800	888

CR501 SERIES

Fin-mounted, three-phase, full-wave types.

CR501	24	300	222
CR502	24	600	444
CR503	46	300	222
CR504	46	600	444
CR505	92	300	222
CR506	92	600	444

♦Check availability in Europe, the Middle East, and Africa.

High-Voltage Rectifier Assemblies

CR101 SERIES—Data Sheet File No. 84 ♦

Rugged high-voltage rectifier stacks with integral R-C voltage-equalizing networks. Diffused-junction RCA rectifier cells are employed.

RCA Type No.	Maximum Peak Reverse Voltage—V Repetitive[a]	Maximum Peak Reverse Voltage—V Non-Repetitive[b]	Average (DC) Forward Current[c]—mA T_A = 60°C	Average (DC) Forward Current[c]—mA T_A = 100°C	Peak Surge Current[d]—A	Max. Reverse Current—mA (Dynamic[e])
CR101	1200	1440	850	350	15	0.3
CR102	2000	2400	825	325	15	0.3
CR103	3000	3600	725	300	15	0.3
CR104	4000	4800	625	275	15	0.3
CR105	5000	6000	625	275	15	0.3
CR106	6000	7200	575	225	15	0.3
CR107	7000	8400	550	210	15	0.3
CR108	8000	9600	550	210	15	0.3
CR109	9000	10800	550	210	15	0.3
CR110	10000	12000	550	210	15	0.3

CR201 SERIES—Data Sheet File No. 86 ♦

Compact high-voltage rectifier stacks with cells precisely matched for internal voltage equalization. Diffused-junction RCA rectifier cells are employed.

CR201	1500	1800	400	155	10	0.1
CR203	3000	3600	400	155	10	0.1
CR204	4500	5400	400	155	10	0.1
CR206	6000	7200	400	155	10	0.1
CR208	8000	9600	400	155	10	0.1
CR210	10000	12000	400	155	10	0.1
CR212	12000	14400	400	155	10	0.1

[a] This value is also the maximum dc blocking voltage.

[b] At free-air temperatures from 60°C to 125°C, for maximum duration of 5 milliseconds.

[c] The RMS supply current in half-wave rectifier service is 1.57 times the specified average (DC) forward current.

[d] For one cycle, 60-Hz, sine wave. Superimposed on device operating within the maximum specified voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

* Maximum reverse current average over one complete cycle and for operation at the maximum ratings.

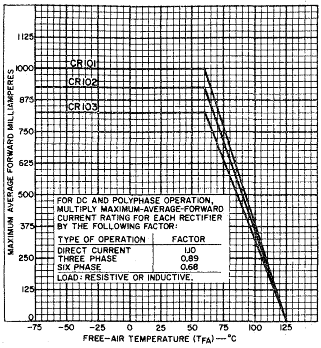


Fig. 21 — Maximum average forward current vs. ambient temperature for CR101, CR102, and CR103.

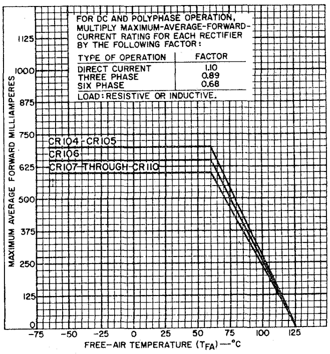


Fig. 22 — Maximum average forward current vs. ambient temperature for CR104—CR110.

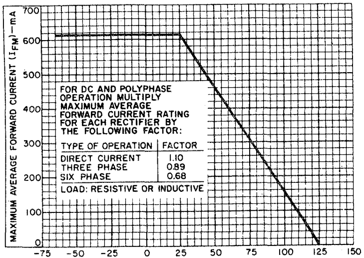


Fig. 23 — Maximum average forward current vs. ambient temperature for CR201 series.

CR273 SERIES ♦

DIRECT PLUG-IN TUBE REPLACEMENT TYPES

Encapsulated Plug-In Package (4-Pin Bayonet Base)
Operating-Temperature Range: —50 to +60°C

RCA Type No.	Peak Reverse Voltage (kV)	Average Current (A)	Peak Current (A)	Type(s) Replaced	Data Sheet File No.
CR273/8008	10	1.25	5.0	8008	100
CR274/872A	10	1.25	5.0	872, 872A	102
CR275/866A/3B28/3B25	10	0.25	1.0	866, 866A, 3B28, 3B25	104

These high-voltage types are direct replacements for the mercury vapor and gas rectifier tubes indicated.

♦Check availability in Europe, the Middle East, and Africa.

High-Voltage Rectifier Assemblies

CR301 SERIES—Data Sheet File No. 60 ◆

Fin-mounted high-voltage rectifier stacks with integral R-C voltage-equalizing networks. Diffused-junction RCA rectifier cells are employed.

RCA Type No.	Maximum Peak Reverse Voltage—V		Average (DC) Forward Current[c]—mA		Peak Surge Current[d]—A	Max. Reverse Current—mA (Dynamic[e])
	Repetitive [a]	Non—Repetitive[b]	T_A = 50°C	T_A = 100°C		
CR301	2400	2880	5	2.5	250	1.5
CR302	3600	4320	5	2.5	250	1.5
CR303	4800	5760	5	2.5	250	1.5
CR304	6000	7200	5	2.5	250	1.5
CR305	7200	8640	5	2.5	250	1.5
CR306	8400	10080	5	2.5	250	1.5
CR307	9600	11520	5	2.5	250	1.5
CR311	2400	2880	9	4.5	250	1.5
CR312	3600	4320	9	4.5	250	1.5
CR313	4800	5760	9	4.5	250	1.5
CR314	6000	7200	9	4.5	250	1.5
CR315	7200	8640	9	4.5	250	1.5
CR316	8400	10080	9	4.5	250	1.5
CR317	9600	11520	9	4.5	250	1.5
CR321	2400	2880	12	6	400	1.5
CR322	3600	4320	12	6	400	1.5
CR323	4800	5760	12	6	400	1.5
CR324	6000	7200	12	6	400	1.5
CR325	7200	8640	12	6	400	1.5
CR331	2400	2880	17	8.5	400	1.5
CR332	3600	4320	17	8.5	400	1.5
CR333	4800	5760	17	8.5	400	1.5
CR334	6000	7200	17	8.5	400	1.5
CR335	7200	8640	17	8.5	400	1.5
CR341	2400	2880	23	11.5	850	1.5
CR342	3600	4320	23	11.5	850	1.5
CR343	4800	5760	23	11.5	850	1.5
CR344	6000	7200	23	11.5	850	1.5
CR351	2400	2880	35	17.5	850	1.5
CR352	3600	4320	35	17.5	850	1.5
CR353	4800	5760	35	17.5	850	1.5
CR354	6000	7200	35	17.5	850	1.5

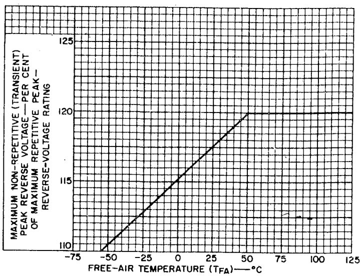


Fig. 24 — Derating curve for CR301—CR307, CR311—CR317, CR321—CR325, CR331—CR335, CR341—CR344, CR351—CR354.

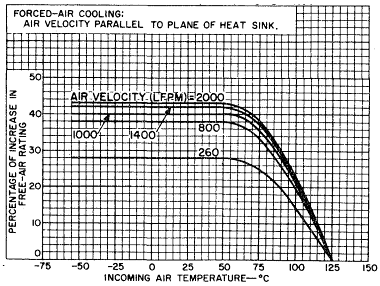


Fig. 25 — Forced-air cooling derating curve for CR301—CR307, CR311—CR317, CR321—CR325, CR331—CR335, CR341—CR344, CR351—CR354.

CR601 SERIES ◆

HIGH VOLTAGE STACKS — For Military and Industrial Use

CR601	2400	2640	5		250	1
CR602	4000	4400	5		250	1.5
CR603	6000	6600	5		250	1.5

[a] This value is also the maximum dc blocking voltage.

[b] At free-air temperatures from 50°C to 125°C, for maximum duration of 5 milliseconds.

[c] The RMS supply current in half-wave rectifier service is 1.57 times the specified average (DC) forward current.

[d] For one cycle, 60-Hz, sine wave. Superimposed on device operating within the maximum specified voltage, current and temperature ratings and may be repeated after sufficient time elapsed for the device to return to the presurge thermal-equilibrium conditions.

[e] Maximum reverse current averaged over one complete cycle and for operation at the maximum ratings.

◆Check availability in Europe, the Middle East, and Africa.

High-Reliability Power Devices

Preconditioning and Screening

High-Reliability Power Devices

Solid-state devices classified as high-reliability types have come to be primarily associated with military and aerospace applications. In many ways, this association is misleading because the commercial equipment market is probably the largest user of high-reliability products, but not necessarily by that label. Military and aerospace agencies, however, have been largely responsible for establishment of comprehensive published reliability specifications and standards which have been accepted by the solid-state industry. MIL standards dominate the procedures used to specify high-reliability solid-state devices and represent a common reference point frequently used by commercial users to define their requirements.

Military and aerospace requirements for high-reliability solid-state devices are extremely large and diverse, not only in terms of performance, operating conditions, and reliability, but also in terms of logistics and procurement. As a result of these requirements, the military services have jointly developed specifications and standards under which most military end-use solid-state devices are procured. To simplify procurement, logistics, and the development of reliability data, MIL specs are not issued for the full spectrum of devices manufactured; rather, they are restricted to those devices for which significant need is demonstrated and are specified so that the device can have as wide applicability as possible. Although the limits for operating conditions may exceed those required for some applications, they simplify procurement and assure a supply of devices for the majority of military equipment. These standards also cover a wide range of requirements for the manufacturer on such things as:

(a) The procedure and requirements for a manufacturer to become certified to manufacture MIL-spec parts.
(b) The requirements for qualifying parts.
(c) Product-assurance provisions in such areas as quality control, inspection procedures, personnel training, cleanliness, failure analysis, and documentation.
(d) Test methods and procedures.
(e) Marking and identification of product.
(f) Preservation and packing.

JAN, JANTX, AND JANTXV SOLID-STATE DEVICES

The major military specification used for the procurement of standard solid-state devices by the military is MIL-S-19500, which covers devices such as discrete transistors, thyristors, and diodes.

MIL-S-19500 is the specification for the familiar "JAN"-type solid-state device. Detailed electrical specifications are prepared as needed by the three military services and coordinated by the Defense Electronic Supply Center. At present, approximately five hundred detailed electrical specifications are included in the MIL-S-19500 system.

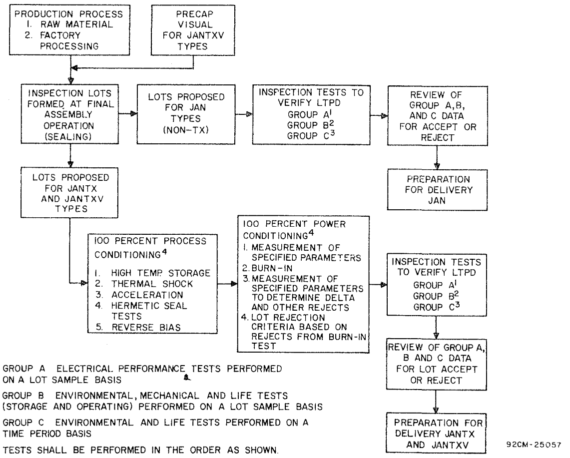
Three levels of reliability, JAN, TX, and TXV, are defined by MIL-S-19500. Devices designated as JAN types receive lot screening only and are the least expensive. Devices designated as TX receive some 100-per-cent screening (primarily burn-in) and a tight lot-sampling plan. Not all detailed specifications include TX requirements. Devices designated as TXV are tested the same as TX devices; however, they receive an additional visual inspection prior to sealing the package. Only a few detailed specifications include TXV testing.

Fig. 1 shows the processing requirements specified by MIL-S-19500 for JAN, JANTX, and JANTXV solid-state power devices.

The Defense Electronic Supply Center maintains a "Qualified Products List" of all vendors qualified to produce devices in accordance with MIL-S-19500. This list is published periodically and is available to manufacturers of military equipment. NASA, to date, has not been a heavy user of MIL-S-19500, preferring instead to procure devices to their own specifications.

RCA offers a number of solid-state power devices that have been qualified as JAN, JANTX, and/or JANTXV devices in accordance with MIL-S-19500.

Table I shows the wide product line of JAN, JANTX, and JANTXV military-specification solid-state power devices available from RCA for high-reliability applications in military, aerospace, and critical industrial usage. These devices, which include power transistors, rf power transistors, and silicon controlled rectifiers (SCR's), are processed in accordance with the MIL-S-19500 general specifications. MIL-STD-750 test methods are used as required by the individual military detail specification. This table lists the individual MIL-S-19500 specification number for each family of devices



1. GROUP A ELECTRICAL PERFORMANCE TESTS PERFORMED ON A LOT SAMPLE BASIS
2. GROUP B ENVIRONMENTAL, MECHANICAL AND LIFE TESTS (STORAGE AND OPERATING) PERFORMED ON A LOT SAMPLE BASIS
3. GROUP C ENVIRONMENTAL AND LIFE TESTS PERFORMED ON A TIME PERIOD BASIS
4. TESTS SHALL BE PERFORMED IN THE ORDER AS SHOWN.

Fig. 1 – Order of procedure diagram for JAN, JANTX, and JANTXV solid-state devices.

TABLE – RCA JAN, JANTX, and JANTXV Solid-State Power Devices

Parent Type	Military Specification Type	MIL-S-19500/*
	POWER TRANSISTORS	
	Hometaxial-Base Types	
2N1479	JAN2N1479	207
2N1480	JAN2N1480	207
2N1481	JAN2N1481	207
2N1482	JAN2N1482	207
2N1483	JAN2N1483, JANTX2N1483	180
2N1484	JAN2N1484, JANTX2N1484	180
2N1485	JAN2N1485, JANTX2N1485	180
2N1486	JAN2N1486, JANTX2N1486	180
2N1487	JAN2N1487	208
2N1488	JAN2N1488	208
2N1489	JAN2N1489	208
2N1490	JAN2N1490	208
2N3055	JAN2N3055, JANTX2N3055	407
2N3441	JAN2N3441, JANTX2N3441	369
2N3442	JAN2N3442	370
2N3771	JAN2N3771, JANTX2N3771	413
2N3772	JAN2N3772, JANTX2N3772	413

* MIL-S-19500 specifications can be obtained from the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphis, Pa. 19120.

TABLE – RCA JAN, JANTX, and JANTXV Solid-State Power Devices (cont'd)

Parent Type	Military Specification Type	MIL-S-19500/*
	POWER TRANSISTORS (Cont'd)	
	High-Voltage Types	
2N3439	JAN2N3439, JANTX2N3439	368
2N3440	JAN2N3440, JANTX2N3440	368
2N3584	JAN2N3584, JANTX2N3584, JANTXV2N3585	384
2N3585	JAN2N3585, JANTX2N3585, JANTXV2N3585	384
2N5415	JAN2N5415, JANTX2N5415	485
2N5416	JAN2N5416, JANTX2N5416	485
2N5838	JAN2N5838, JANTX2N5838	487
2N5839	JAN2N5839, JANTX2N5839	487
2N5840	JAN2N5840, JANTX2N5840	487
2N6211	JAN2N6211, JANTX2N6211	461
2N6212	JAN2N6212, JANTX2N6212	461
2N6213	JAN2N6213, JANTX2N6213	461
2N6249	JAN2N6249, JANTX2N6249, JANTXV2N6249	510
2N6250	JAN2N6250, JANTX2N6250, JANTXV2N6250	510
2N6251	JAN2N6251, JANTX2N6251, JANTXV2N6251	510
2N6306	JAN2N6306, JANTX2N6306, JANTXV2N6308	498
2N6308	JAN2N6308, JANTX2N6308, JANTXV2N6308	498
	High-Speed Types	
2N5038	JAN2N5038, JANTX2N5038, JANTXV2N5038	439
2N5039	JAN2N5039, JANTX2N5039, JANTXV2N5039	439
2N5671	JAN2N5671, JANTX2N5671	488
2N5672	JAN2N5672, JANTX2N5672	488
	RF POWER TRANSISTORS	
2N918	JAN2N918, JANTX2N918	301
2N1493	JAN2N1493	247
2N2857	JAN2N2857, JANTX2N2857	343
2N3375	JAN2N3375, JANTX2N3375	341
2N3553	JAN2N3553, JANTX2N3553	341
2N4440	JAN2N4440, JANTX2N4440	341
2N3866	JAN2N3866, JANTX2N3866	398
2N5071	JAN2N5071, JANTX2N7071	442
2N5109	JAN2N5109 JANTX2N5109	453
	SILICON CONTROLLED RECTIFIERS (SCR's)	
2N682	JAN2N682, JANTX2N682	108
2N683	JAN2N683, JANTX2N683	108
2N685	JAN2N685, JANTX2N685	108
2N687	JAN2N687, JANTX2N687	108
2N688	JAN2N688, JANTX2N688	108
2N689	JAN2N689, JANTX2N689	108
2N690	JAN2N690, JANTX2N690	108
	TRIACS	
2N5806	JAN2N5806	438
2N5807	JAN2N5807	438
2N5808	JAN2N5808	438
2N5809	JAN2N5809	438

* MIL-S-19500 specifications can be obtained from the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphis, Pa. 19120.

Note: Ratings and characteristics data shown for the parent types earlier in this DATABOOK are also applicable to the JAN, JANTX, and JANTXU types.

TABLE II – LTPD sampling plans 1/ 2/ 3/

Minimum size of sample to be tested to assure, with a 90 percent confidence, that a lot having percent-defective equal to the specified LTPD will not be accepted (single sample).

Max. Percent Defective (LTPD) or λ	20	15	10	7	5	3	2	1.5	1	0.7	0.5	0.3
Acceptance Number (c) (r = c + 1)	Minimum Sample Sizes (For device-hours required for life test, multiply by 1000)											
0	11 (0.46)	15 (0.34)	22 (0.23)	32 (0.16)	45 (0.11)	76 (0.07)	116 (0.04)	153 (0.03)	231 (0.02)	328 (0.02)	461 (0.01)	767 (0.007)
1	18 (2.0)	25 (1.4)	38 (0.94)	55 (0.65)	77 (0.46)	129 (0.28)	195 (0.18)	258 (0.14)	390 (0.09)	555 (0.06)	778 (0.045)	1296 (0.027)
2	25 (3.4)	34 (2.24)	52 (1.6)	75 (1.1)	105 (0.78)	176 (0.47)	266 (0.31)	354 (0.23)	533 (0.15)	759 (0.11)	1065 (0.080)	1773 (0.045)
3	32 (4.4)	43 (3.2)	65 (2.1)	94 (1.5)	132 (1.0)	221 (0.62)	333 (0.41)	444 (0.31)	668 (0.20)	953 (0.14)	1337 (0.10)	2226 (0.062)
4	38 (5.3)	52 (3.9)	78 (2.6)	113 (1.8)	158 (1.3)	265 (0.75)	398 (0.50)	531 (0.37)	798 (0.25)	1140 (0.17)	1599 (0.12)	2663 (0.074)
5	45 (6.0)	60 (4.4)	91 (2.9)	131 (2.0)	184 (1.4)	308 (0.85)	462 (0.57)	617 (0.42)	927 (0.28)	1323 (0.20)	1855 (0.14)	3090 (0.085)
6	51 (6.6)	68 (4.9)	104 (3.2)	149 (2.2)	209 (1.6)	349 (0.94)	528 (0.62)	700 (0.47)	1054 (0.31)	1503 (0.22)	2107 (0.155)	3509 (0.093)
7	57 (7.2)	77 (5.3)	116 (3.5)	166 (2.4)	234 (1.7)	390 (1.0)	589 (0.67)	783 (0.51)	1178 (0.34)	1680 (0.24)	2355 (0.17)	3922 (0.101)
8	63 (7.7)	85 (5.6)	128 (3.7)	184 (2.6)	258 (1.8)	431 (1.1)	648 (0.72)	864 (0.54)	1300 (0.36)	1854 (0.25)	2599 (0.18)	4329 (0.108)
9	69 (8.1)	93 (6.0)	140 (3.9)	201 (2.7)	282 (1.9)	471 (1.2)	709 (0.77)	945 (0.58)	1421 (0.38)	2027 (0.27)	2842 (0.19)	4733 (0.114)
10	75 (8.4)	100 (6.3)	152 (4.1)	218 (2.9)	306 (2.0)	511 (1.2)	770 (0.80)	1025 (0.60)	1541 (0.40)	2199 (0.28)	3082 (0.20)	5133 (0.120)

1/ Sample sizes are based upon the Poisson exponential binomial limit.
2/ The minimum quality (approximate AQL) required to accept (on the average) 19 of 20 lots is shown in parenthesis for information only.
3/ This sampling plan is derived from Table C-1 in Appendix C of MIL-S-19500.

RCA NON-JAN TYPE SOLID-STATE DEVICES

Many solid-state devices are not covered by military specifications, either because they are too new or are not used in sufficient quantities. Many of these devices offer the most recent technological advances or have special performance characteristics which offer advantages to the designer of high-reliability equipment. RCA cooperates with the users of such devices in establishment of high-reliability specifications patterned after MIL standards, which allow these designs to be approved for use in military and aerospace systems, as well as commercial equipment. If the use warrants, these specifications may be submitted by RCA, or the user, to the cognizant military specification agency as candidates for MIL approval as a standard type.

Most procurements of solid-state devices for military systems are made by the equipment contractor from the MIL-STD parts list as awards are received for electronic equipment. Some military and aerospace programs, because of their size, duration, or special requirements (Minuteman and Apollo are two examples), require that special specifications and process methods, or even special production lines, be established and tailored to the particular functional, reliability, and economic needs of the program. RCA Solid State Division has frequently used the resources of its laboratories, production facilities, and expert technical staff to contribute to the success of such programs.

All RCA high-reliability solid-state power devices are processed in accordance with the provisions of MIL-S-19500. These provisions include the following items:

1. A clearly defined procedure for the conversion of a customer specification into an RCA internal specification with built-in safeguards to assure the customer that the delivered parts meet or exceed his specification requirements.
2. A formalized personnel training and testing program which assures that each operation is performed correctly.
3. A complete inspection of incoming materials, utilities, and work in process using on-site facilities such as scanning-electron-microscope and X-ray equipment.
4. Maintenance of cleanliness in work areas.
5. Rigorous control over changes in design, materials, and processes with documentation kept in active files for a minimum of three years.
6. Tool and test equipment maintenance and calibration in strict accordance with MIL-C-45662, "Calibration System Requirements."
7. A quality-assurance program in accordance with MIL-Q-9858, "Quality Program Requirements."

The *Lot Sampling* plans used for RCA high-reliability solid-state power devices, as defined by MIL-S-19500 and MIL-STD 105D, are shown in Tables II, III, and IV. Detailed processing and screening requirements for RCA high-reliability power transistors, thyristors (triacs and SCR's), and rf power transistors are described in the following paragraphs.

TABLE III – Sample Size Code Letters*

Lot or batch size			General inspection levels		
			I	II	III
2	to	8	A	A	B
9	to	15	A	B	C
16	to	25	B	C	D
26	to	50	C	D	E
51	to	90	C	E	F
91	to	150	D	F	G
151	to	280	E	G	H
281	to	500	F	H	J
501	to	1200	G	J	K
1201	to	3200	H	K	L
3201	to	10000	J	L	M
10001	to	35000	K	M	N
35001	to	150000	L	N	P
150001	to	500000	M	P	Q
500001	and	over	N	Q	R

* Derived from Table I of MIL-STD-105D

TABLE IV – Single Sampling Plans for Normal Inspection*

Sample size code letter	Sample size	Acceptable Quality Levels (normal inspection)																	
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A	2	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2
B	3	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	1 2	2 3
C	5	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	1 2	2 3	3 4
D	8	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	1 2	2 3	3 4	5 6
E	13	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	1 2	2 3	3 4	5 6	7 8
F	20	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	1 2	2 3	3 4	5 6	7 8	10 11
G	32	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15
H	50	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22
J	80	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇧
K	125	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇧	⇧
L	200	⇩	⇩	⇩	⇩	0 1	⇧	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇧	⇧	⇧
M	315	⇩	⇩	⇩	0 1	⇧	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇧	⇧	⇧	⇧
N	500	⇩	⇩	0 1	⇧	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇧	⇧	⇧	⇧	⇧
P	800	⇩	0 1	⇧	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇧	⇧	⇧	⇧	⇧	⇧
Q	1250	0 1	⇧	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇧	⇧	⇧	⇧	⇧	⇧	⇧
R	2000	⇧	⇧	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧

⇩ = Use first sampling plan below arrow. If sample size equals, or exceeds, lot or batch size, do 100 percent inspection.
⇧ = Use first sampling plan above arrow.

Ac = Acceptance number.
Re = Rejection number.

* Derived from Table II-A of MIL-STD-105D

Power Transistors

In addition to JAN, JANTX, and JANTXV types, high-reliability selections of all RCA power transistors can be obtained on a custom basis. Such power transistors are subjected to high-reliability preconditioning and screening in accordance with the Group A, B, and C Sampling Tests as specified in MIL-STD-750 or special customer requirements. These power transistors can be supplied to four basic reliability levels. The preconditioning and screening for Level 1 is the same as that for JANTXV devices and, in addition, includes X-ray inspection. Level 2 corresponds directly to the JANTXV level. Level 3 devices are equivalent to JANTX devices. For RCA Level 4 devices, the preconditioning consists of burn-in only.

Fig. 2 shows the basic processing steps required for RCA high-reliability power transistors for each reliability level, and Table V lists the screening tests to which these devices are subjected. Tables VI, VII, and VIII list the Groups A, B, and C Sampling Tests and the test methods specified by MIL-STD-750.

Thyristors (Triacs and SCR's)

RCA high-reliability thyristors that are subjected to high-reliability preconditioning and screening in accordance with the Group A, B, and C Sampling Tests as specified in MIL-STD-750 or special customer requirements can be obtained on a custom basis. These thyristors can be supplied to four basic reliability levels that are approximately equivalent to, or exceed, the reliability classes (JAN, JANTX, JANTXV) defined by MIL-S-19500.

Fig. 3 shows the basic processing steps required for RCA high-reliability thyristors for each reliability level, and Table IX lists the screening tests to which these devices are subjected. Tables X, XI, and XII list the Groups A, B, and C Sampling Tests and the test methods specified by MIL-STD-750.

RF Power Transistors

RCA supplies several transistors referred to as premium- or ultra-high-reliability types. Processing and screening requirements and ratings and electrical characteristics for these transistors are included in the "RCA High-Reliability DATABOOK", SSD-230.

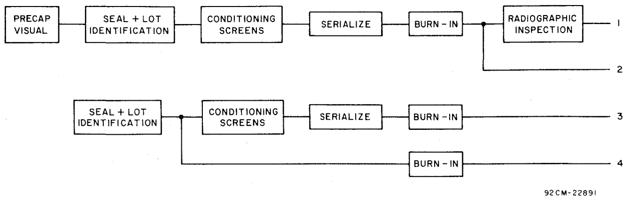


Fig. 2 – Process-flow chart for four reliability levels of RCA high-reliability power transistors.

TABLE V – Screening Tests for RCA High-Reliability Power Transistors

Test	Conditions	MIL-STD-750 Method	MIL-STD-750 Conditions	Screening Levels 1	2	3	4
1. Precap Visual		2072		X	X		
2. Seal and Lot Identification				X	X	X	X
3. High Temp Storage	24 hrs at 200°C			X	X	X	
4. Temperature Cycling	10 cycles	1051	C	X	X	X	
5. Acceleration	Y_1 direction	2006		X	X	X	
6. Fine Leak		1071	G or H	X	X	X	
7. Gross Leak		1071	A,C,D or F	X	X	X	
8. Reverse Bias	24 hrs at 150°C	1039	A	X	X	X	
9. Serialize				X	X	X	
10. Pre Burn-in Electrical				X	X	X	
11. Burn-in	168 hrs at 25°C	1039	B	X	X	X	X
12. Post Burn-in Electrical				X	X	X	
13. Final Electrical				X	X	X	X
14. Radiographic Inspection		2076		X			
15. External Visual		2071		X	X	X	

Specific test conditions and limits determined by each type of transistor.

TABLE VI – Group A Inspections (power transistors)

Subgroup	Test	MIL-STD-750 Method
1	Visual & Mech Examination	2071
2	BV_{CEO}, BV_{CER}, or BV_{CEX}	3011
	I_{CEO}, I_{CER}, or I_{CEX}	3041
	I_{EBO}	3061
3	h_{FE}	3076
	$V_{CE(sat)}$	3071
	V_{BE}	3066
4	h_{FE}	3306
	C_{obo}	3236
	t_{on}	3251
	t_{off}	3251
5	150°C I_{CEX}	3041
	−65°C h_{FE}	3076

TABLE VII – Group B Inspections (power transistors)

Subgroup	Test	MIL-STD-750 Method
1	Physical dimensions	2066
2	Solderability	2026
	Temperature Cycling	1051
	Moisture Resistance	1021
3	Shock	2016
	Vibration, Variable Frequency	2056
	Constant Accleration	2066
4	Safe Operating Area	3051
5	High Temperature Life	1031
6	Steady-State Operation Life	1026

TABLE VIII – Group C Inspections (power transistors)

Subgroup	Test	MIL-STD-750 Method
1	Barometric Pressure	1001
2	Salt Atmosphere	1041

TABLE X – Group A Tests (triacs and SCR's)

Subgroup	Test	MIL-STD-750 Method
1	Visual	2071
2	Forward blocking current	4206.1
2	Reverse blocking current	4211.1
3	High-temp. forward blocking current	
3	High-temp. reverse blocking current	
3	High-temp. gate-trigger voltage or gate-trigger current	4221.1
3	Exponential rate of voltage rise	4231.2
4	Gate-trigger voltage or gate-trigger current at 25°C	
4	Gate-controlled turn-on time	4223
4	Circuit-commutated turn-off time	4224
4	Gate-controlled turn-off time	4225
4	Forward "on" voltage	4226.1
4	Holding current	4201.2

TABLE IX – Screening Test for High-Reliability Thyristors

Test	Condition	MIL-STD-750 Method	MIL-STD-750 Conditions	Screening Levels 1	2	3	4
1. Precap visual	20 power			X			
2. Seal and lot identification				X	X	X	X
3. High-temperature Storage	24 hrs. at 150°C	1031		X	X		
4. Temperature cycling	Low temperature per device	1051	F	X	X		
5. Acceleration	Y_1 direction	2006		X	X		
6. Hermeticity-fine leak		1071	H	X	X	X	
7. Hermeticity-gross leak		1071	D	X	X		
8. Serialize				X			
9. Preburn-in electrical-record				X			
10. Preburn-in electrical					X	X	X
11. Burn-in	24 to 168 hrs.; 100°C to 125°C			X	X	X	X
12. Post burn-in electrical					X	X	X
13. Post burn-in electrical-record Δ's				X			
14. Final electrical				X	X		
15. Hermeticity-fine leak				X	X		
16. Hermeticity-gross leak				X			
17. Radiographic		2076		X			
18. External visual		2071		X			

TABLE XI – Group B Tests (triacs and SCR's)

Test	MIL-STD-750 Method
Reverse gate current	4219
Surge current	4066
Temperature cycling	1051
Thermal shock (glass strain)	1056
Terminal strength	2036
Moisture resistance	1021
AC blocking voltage	–

TABLE XII – Group C Tests (triacs and SCR's)

Subgroup	Test	MIL-STD-750 Method
1	Physical dimensions	2066
2	Shock	2016
2	Vibration, variable-frequency	2056
2	Constant acceleration	2006
3	Barometric pressure	1001
4	Salt atmosphere	1041
5	Solderability	2026
6	Intermittent life	–

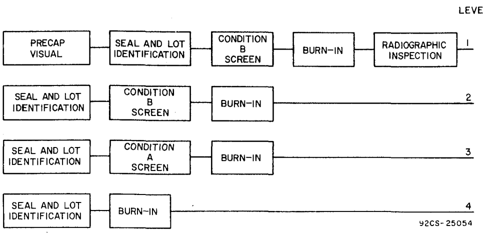


Fig. 3 – Basic processing and screening required for RCA high-reliability triacs and SCR's.

Appendix

General Characteristics, Test Circuits, and Waveforms

POWER TRANSISTORS

Dissipation Derating Chart

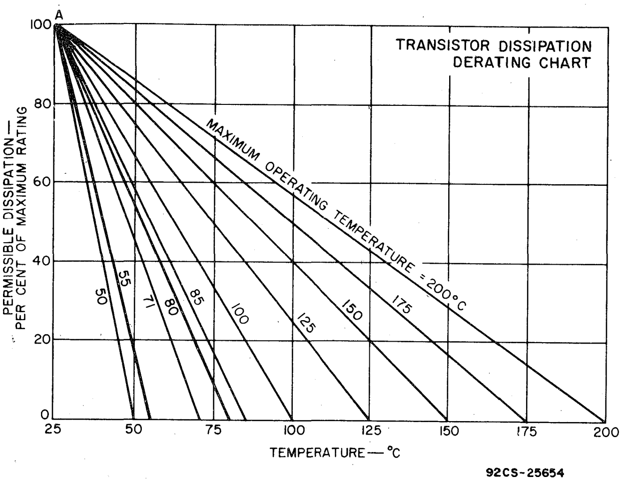


Fig.1 – Dissipation derating chart for silicon power transistors operated at temperatures above 25°C.

For many transistors, the maximum value of dissipation is specified for ambient, case, or mounting-flange temperatures up to 25°C, and must be reduced linearly for higher temperatures. For such types, the chart above can be used to determine maximum permissible dissipation values at particular temperature conditions above 25°C. (This chart cannot be assumed to apply to types other than those for which it is specified that the maximum allowable dissipation is derated linearly to zero at the maximum allowable operating temperature, T_J (max.).) The curves show the permissible percentage of the maximum dissipation ratings as a function of ambient or case temperature. Individual curves are plotted for maximum operating temperatures of 50, 55, 75, 80, 85, 100, 125, 150, 175, and 200°C. If the maximum operating temperature of a transistor is some other value, a new curve can be drawn from point A in the figure to the desired temperature value on the abscissa.

To use the chart, it is necessary to know the maximum dissipation rating and the maximum operating temperature for a given transistor. The calculation involves only two steps:

1. A vertical line is drawn at the desired operating temperature value on the abscissa to intersect the curve representing the maximum operating temperature for the transistor.

2. A horizontal line drawn from this intersection point to the ordinate establishes the permissible percentage of the maximum dissipation at the given temperature.

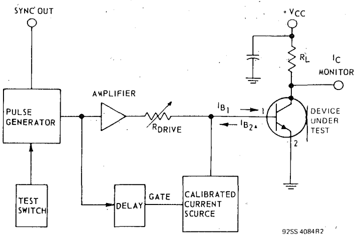
The following example illustrates the calculation of the maximum permissible dissipation for transistor type 2N1487 at a case temperature of 100°C. This type has a maximum dissipation rating of 75 watts at a case temperature of 25°C, and a maximum permissible case-temperature rating of 200°C.

1. A perpendicular line is drawn from the 100-degree point on the abscissa to the 200-degree curve.

2. Projection of this point to the ordinate shows a percentage of 57.5.

Therefore, the maximum permissible dissipation for the 2N1487 at a case temperature of 100°C is 0.575 times 75, or approximately 43 watts.

Switching-Time Measurements



•I_{B1} AND I_{B2} MEASURED WITH TEKTRONIX CURRENT PROBE P6019 OR EQUIVALENT

* For p-n-p types, direction of currents and polarities of voltages are reversed.

Fig.2 – Circuit used to measure switching times.

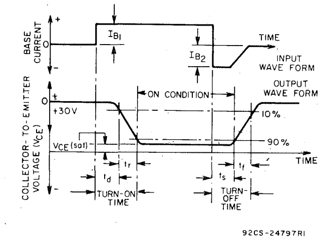


Fig.3 – Oscilloscope display for measurement of switching times.

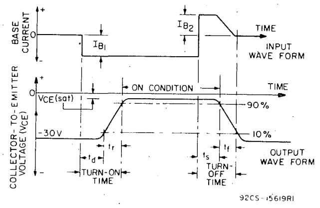
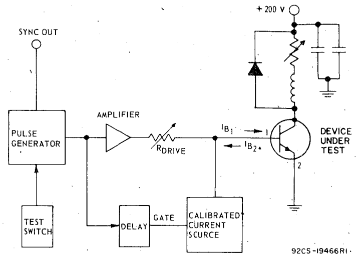


Fig.4 – Oscilloscope display for measurement of switching times for p-n-p types.



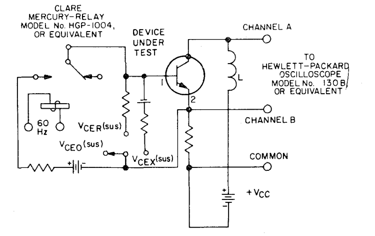
•I_{B1} AND I_{B2} MEASURED WITH TEKTRONIX CURRENT PROBE P6019 OR EQUIVALENT

* For p-n-p types, direction of currents and polarities of voltages are reversed.

Fig.5 – Circuit used to measure inductive-load switching times.

POWER TRANSISTORS (Cont'd)

Breakdown (Sustaining) Voltage Tests



L = 15 mH for V_{CEO}(sus) and V_{CER}(sus) measurements
L = 2 mH for V_{CEX}(sus) measurements

92CS-27770

Fig.6 — Basic configuration used to measure sustaining voltage $V_{CEO}(sus)$, $V_{CER}(sus)$, and $V_{CEX}(sus)$ for n-p-n power transistors.

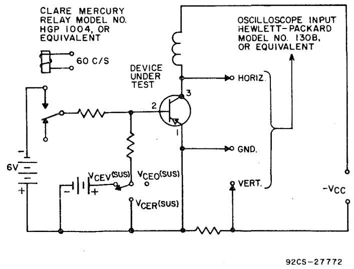
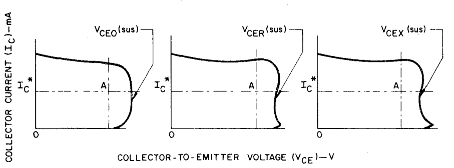


Fig.8 — Basic circuit configuration used to measure sustaining voltages $V_{CEO}(sus)$, $V_{CER}(sus)$, and $V_{CEV}(sus)$ for p-n-p power transistors.

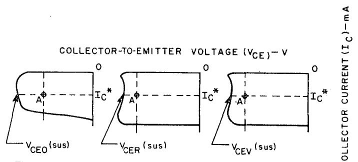


The sustaining voltages (V_{CEO}(sus), V_{CER}(sus), and V_{CEX}(sus) are acceptable when the traces fall to the right of point "A", where "A" is the rated value of V_{CEO}(sus), V_{CER}(sus), or V_{CEV}(sus).

*I_C = value specified in technical data for transistor under test (usually forced-beta current)

92CS-27771

Fig.7 — Oscilloscope display for measurement of sustaining voltages of n-p-n power transistors.

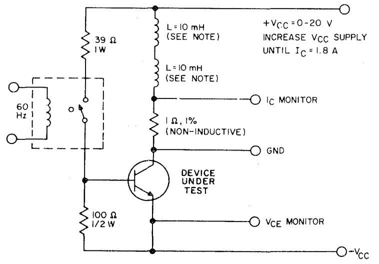


The sustaining voltages V_{CEO}(sus), V_{CER}(sus), and V_{CEV}(sus) are acceptable when the traces fall to the left and below point "A" where "A" is the rated value for V_{CEO}(sus), V_{CER}(sus), or V_{CEV}(sus).

*I_C = value specified in technical data for transistor under test (usually forced-beta current)

Fig.9 — Oscilloscope display for measurement of sustaining voltages of p-n-p power transistors.

Inductive Load-Switching Measurements



NOTE: TWO 10 mH, 0.11 Ω CHICAGO STANDARD TRANSFORMER CORP. NO. C-2688, OR EQUIVALENT.

92CS-20156R1

Fig.10 — Circuit for measuring inductive-load switching for all types.

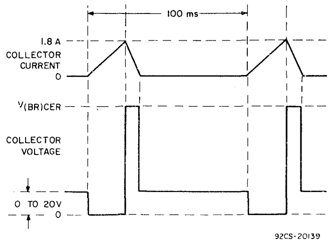


Fig.11 — Inductive-load switching voltage and current waveforms .

HC2000H POWER HYBRID OPERATIONAL AMPLIFIER TEST CIRCUITS

PROCEDURE FOR MEASUREMENT OF COMMON-MODE INPUT IMPEDANCE

a) Insert unit
b) Apply ±37.5 V
c) Close S1
d) Adjust signal generator for 1 V on voltmeter V1
e) Open S1
f) Read voltmeter V1
g) Input impedance = $(10\text{ k})\times\frac{V1}{1-V1}$

Note: Circuit under test must have a heat sink so that $T_C \approx 25^{\circ}C$, unless otherwise noted.

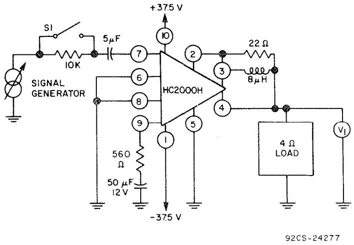


Fig.12 — Circuit for measurement of common-mode input impedance.

PROCEDURE FOR MEASUREMENT OF OFFSET VOLTAGE AND QUIESCENT CURRENT

A = DC ammeter 100 mA range
V = DC voltmeter ± 250 mV range
a) Close S1
b) Insert unit
c) Apply ± 37.5 V
d) Read offset voltage on voltmeter. Change polarity if required.
e) Open S1
f) Read positive and negative quiescent current on ammeter.

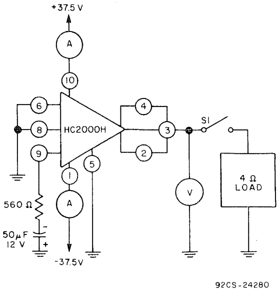


Fig.13 — Circuit for measurement of offset voltage and quiescent current.

HC2000H

TERMINAL CONNECTIONS

Pin No.	Connection	
1	$-V_S$	Negative supply voltage
2	V_{FB}	Feedback voltage
3	V_{OUT}	Output voltage
4	PC	Phase compensation
5	GND	Ground
6	BP	Base plate (internal connection)
7	$+V_{IN}$	Non-inverting input
8	GND	Ground
9	$-V_{IN}$	Inverting input
10	$+V_S$	Positive supply voltage

PROCEDURE FOR MEASUREMENT OF OPEN-LOOP GAIN

a) Insert unit
b) Apply ± 37.5 V
c) Set generator at 1 kHz and adjust until V1 = 10 V rms
d) Read V2
e) Open-loop gain = V1/V2

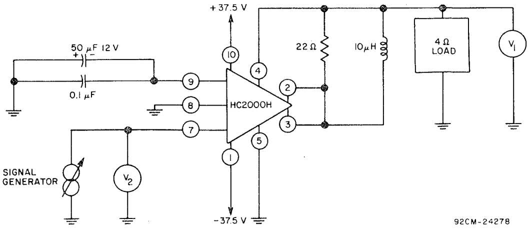


Fig.14 — Circuit for measurement of open-loop gain.

PROCEDURE FOR MEASUREMENT OF CLOSED-LOOP VOLTAGE GAIN

a) Insert unit
b) Adjust signal generator to 1 kHz, V2 = 0
c) Apply ± 37.5 V
d) Adjust signal generator for 2 V rms on voltmeter V1
e) Read voltmeter V2
f) Voltage gain = $\frac{V1}{V2}$

PROCEDURE FOR MEASUREMENT OF TOTAL HARMONIC DISTORTION

a) Adjust signal generator for 15.5 V rms on V1
b) Adjust distortion analyzer. Record the meter reading as Total Harmonic Distortion (THD).

PROCEDURE FOR MEASUREMENT OF MAXIMUM VOLTAGE SWING AND MAXIMUM POWER

a) Adjust signal generator for maximum output on scope No. 1 with no clipping. Read peak voltage as maximum voltage swing.
b) Read V1
c) Maximum power = $\frac{V1^2}{4}$

PROCEDURE FOR MEASUREMENT OF SHORT-CIRCUIT CURRENT

a) Lower power supply to ± 26 V
b) Momentarily replace 4-ohm load with 0.5-ohm load
c) Scope No. 1 must show symmetrical square wave of less than ± 1.75 V

PROCEDURE FOR MEASUREMENT OF BANDWIDTH

a) Raise power supply to ± 37.5 V
b) Adjust signal generator at 43 kHz to 2 V rms on V1
c) Adjust distortion analyzer and verify that THD < 0.5%

PROCEDURE FOR MEASUREMENT OF SLEW RATE

a) Replace signal generator with square-wave generator.
b) Adjust generator for 500 Hz and V1 = 40 V peak-to-peak.
c) Read time required for swing from peak to peak.
d) Slew rate = $\frac{40\text{ V}}{\text{Measured time}}$

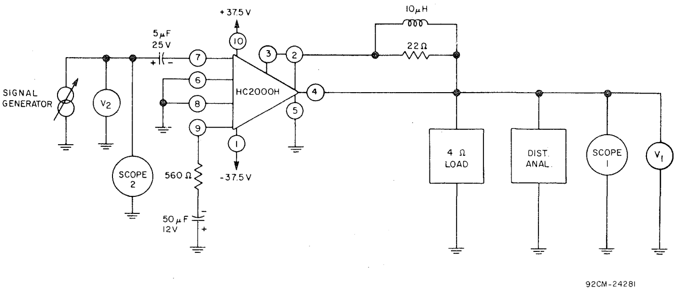
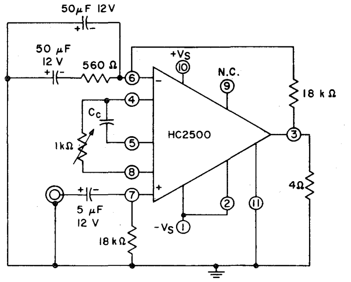


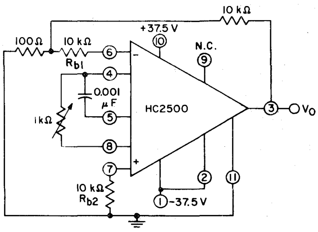
Fig.15 — Circuit for measurement of closed-loop voltage gain, total harmonic distortion, maximum voltage swing, maximum power, short-circuit current, bandwidth, and slew-rate.

HC2500 POWER HYBRID OPERATIONAL AMPLIFIER TEST CIRCUITS



92CS-22509

Fig. 16 — Test circuit for open-loop gain and phase response.



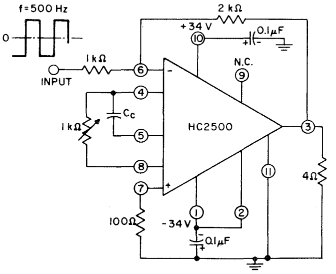
$V_{IO} = -\frac{V_O}{100}$ with R_{b1} and R_{b2} shorted

$I_{IO} = -\frac{V_O}{100\,R_{b2}}$

$I_{Ib} = \frac{\pm V_O}{100\,R_{b2}}$ with R_{b1} shorted

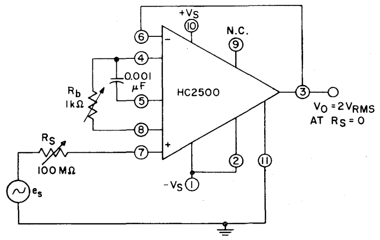
92CS-22510

Fig. 17 — Test circuit for input offset voltage and current test.



92CS-22511

Fig. 18 — Circuit used to test slew rate.



$R_{CM} = 9\,R_S$ with series resistance (R_S) increased from zero until output voltage (V_O) is reduced by 10%.

92CS-22512

Fig. 19 — Test circuit for measuring common-mode input resistance.

HC2500

TERMINAL CONNECTIONS

Pin No.		Connection
1		Drive 2
2	$-V_S$	Negative supply voltage
3	V_{OUT}	Output Voltage
4		Bias adjust
5		Frequency compensation
6	$-V_{IN}$	Inverting input
7	$+V_{IN}$	Noninverting input
8		Bias adjust
9		Drive 1
10	$+V_S$	Positive supply voltage
11	BP	Base plate (electrically isolated from internal circuitry)

THYRISTORS

Voltage-Current Characteristics

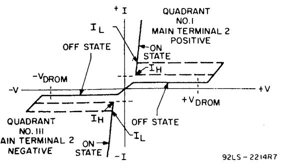


Fig.20 – Principal voltage-current characteristic for a triac.

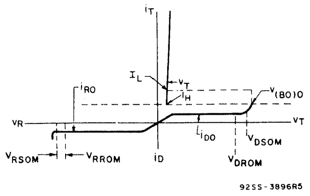


Fig.21 – Principal voltage-current characteristic for a conventional SCR.

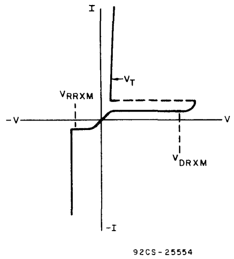


Fig.22 – Anode-cathode voltage-current characteristic for a gate-turn-off SCR (GTO).

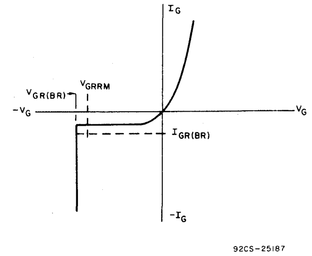


Fig. 23 - Gate-cathode voltage-current characteristic for a gate-turn-off SCR (GTO).

Critical Rate of Rise of Off-State Voltage (Static and Commutating dv/dt)

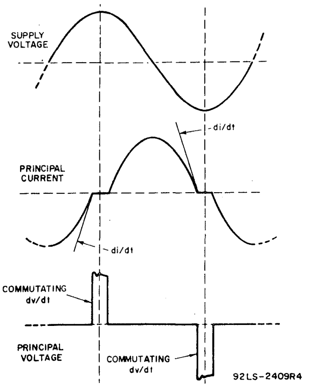


Fig.26 – Relationship between supply voltage and principal current (inductive load) showing reference points for definition of commutating voltage (dv/dt) for a triac.

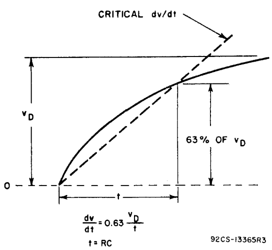


Fig.27 – Rate of rise of off-state voltage with time (defining critical dv/dt) for general-purpose SCR's, gate-turn-off SCR's, and triacs.

Critical Rate of Rise of On-State Current (di/dt)

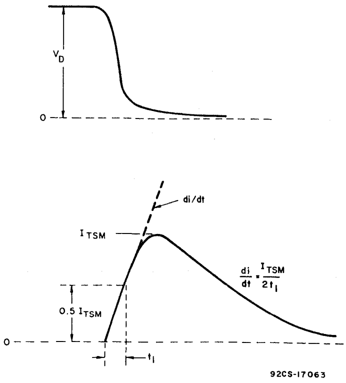


Fig.24 – Rate of change of on-state current with time (defining di/dt) for a triac.

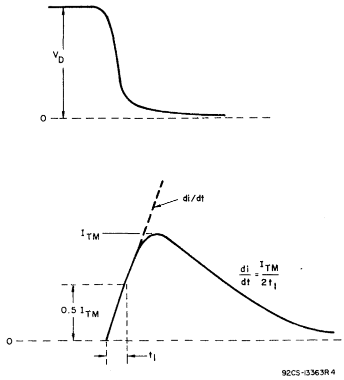


Fig.25 – Rate of change of on-state current with time (defining di/dt) for an SCR.

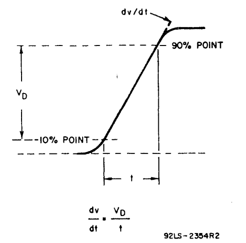


Fig.28 – Rate of rise of off-state voltage with time (defining dv/dt) for an inverter SCR.

THYRISTORS (Cont'd)

Subcycle Surge-Current Test for SCR's

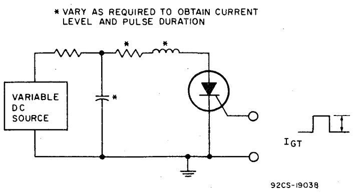
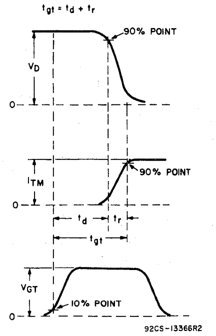


Fig.29 – Sub-cycle surge capability test circuit.

Turn-On-Time Waveforms



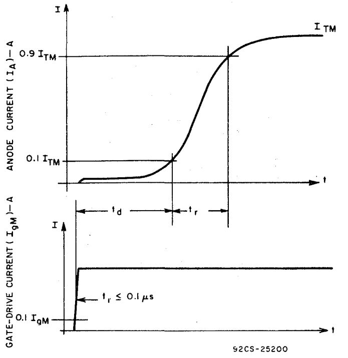


Fig.30 – Relationship between off-state voltage, on-state current, and gate-trigger voltage showing reference points for definition of turn-on time (t_{gt}) for triacs and SCR's.

Fig.31 – Relationship between anode current (on-state), gate drive current, and time showing reference points for definition of gate controlled turn-on time (t_{gt}) for gate-turn-off SCR's.

Turn-Off-Time Test Circuits and Waveforms for SCR's

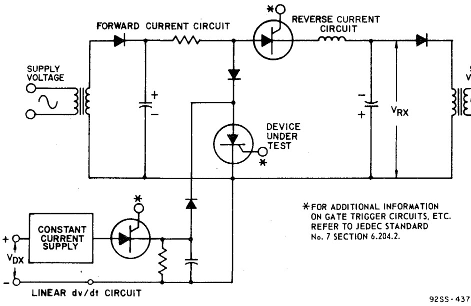


Fig. 32 - Circuit used to measure turn-off time (t_q) rectangular pulse.

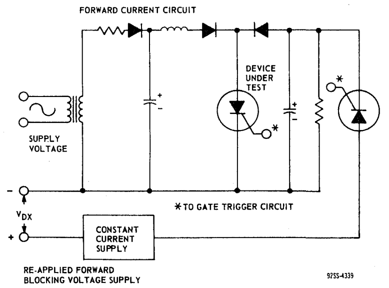
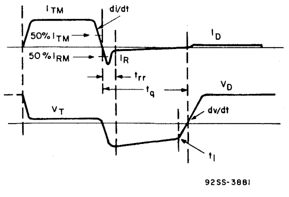
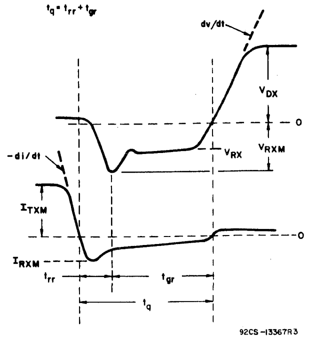


Fig.33 – Circuit used to measure turn-off time (t_q) half-sine wave pulse.





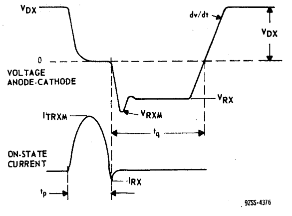


Fig.34 – Relationship between instantaneous on-state current and voltage showing reference points for definition of circuit commutated turn-off time (t_q) for general-purpose SCR's (rectangular pulse).

Fig.35 – Relationship between off-state voltage, reverse voltage, on-state current, and reverse current showing reference points defining turn-off time (t_q) for inverter SCR's (rectangular pulse).

Fig.36 – Relationship between off-state voltage, reverse voltage, on-state current, and reverse current showing reference points for specification of turn-off time (t_q) for an inverter SCR (half-sine-wave pulse).

THYRISTORS (Cont'd)

Switching-Time Waveforms for Gate-Turn-Off SCR's

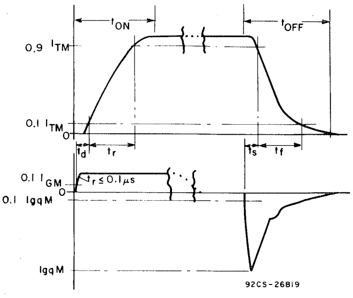


Fig.37 – Relationship between anode current (on-state), gate-drive current, and time showing reference points for definition of t_{gt} (t_{ON}) and t_{gq} (t_{OFF}).

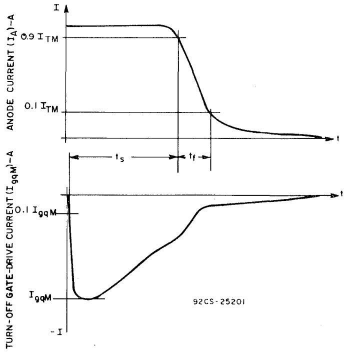
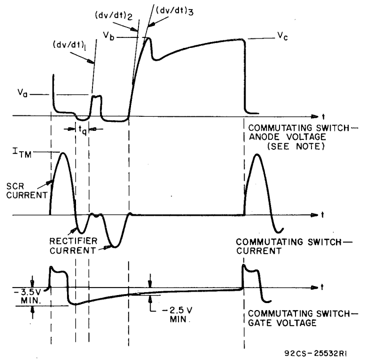


Fig.38 – Relationship between anode current (on-state), turn-off gate-drive current, and time showing reference points for definition of gate-controlled turn-off time (t_{gq}).

Switching Waveforms for Deflection-Circuit ITR's



NOTE: "Commutating Switch-Anode Voltage" oscilloscope display has been modified graphically to show the measurement points of dv/dt more effectively.

Fig.39 – Oscilloscope display of commutating switching ITR's showing circuit-commutated turn-off time (t_q).

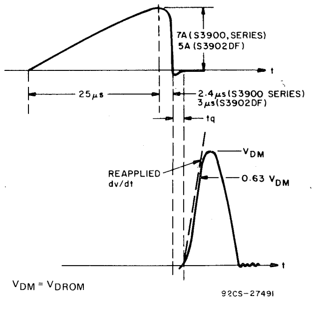


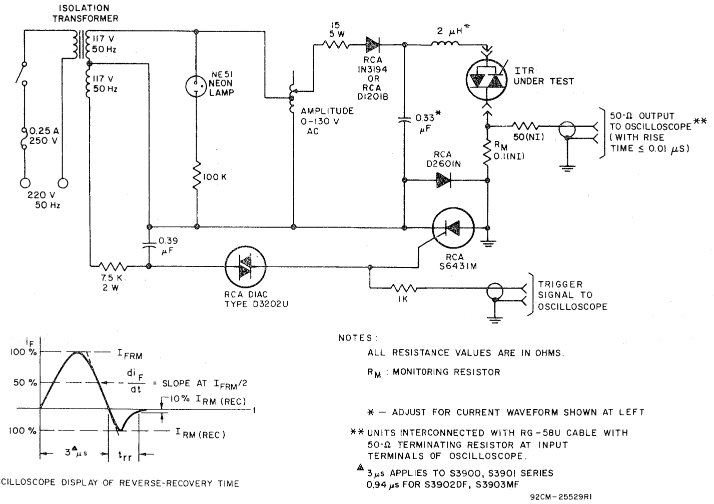
Fig.40 – Oscilloscope display of trace switching ITR's (S3900 Series, S3902DF) showing circuit-commutated turn-off time (t_q).

Notes for Figs. 39 and 40

Circuit-commutated turn-off time (t_q), the sum of reverse recovery time and gate recovery time, is measured from the zero crossing of current to the start of the reapplied voltage. Knowledge of the current, the reapplied voltage, and the case temperature is necessary when measuring t_q. In the worst conditions (high line, zero beam, off-frequency, minimum auxiliary load, etc), turn-off time must not fall below the given values. Turn-off time increases with temperature, therefore, case temperature must not exceed 75°C for all types.

THYRISTORS (Cont'd)

Reverse-Recovery-Time Measurements for Rectifier Unit of ITR



NOTES:

ALL RESISTANCE VALUES ARE IN OHMS.

R_M : MONITORING RESISTOR

* – ADJUST FOR CURRENT WAVEFORM SHOWN AT LEFT

** UNITS INTERCONNECTED WITH RG-58U CABLE WITH 50-Ω TERMINATING RESISTOR AT INPUT TERMINALS OF OSCILLOSCOPE.

▲ 3 μs APPLIES TO S3900, S3901 SERIES 0.94 μs FOR S3902DF, S3903MF

Fig.41 – Test circuit (pulsed sine wave) oscilloscope display for measurement of reverse-recovery time for rectifier unit of ITR.

Peak Forward-Voltage Measurements for Rectifier Unit of ITR

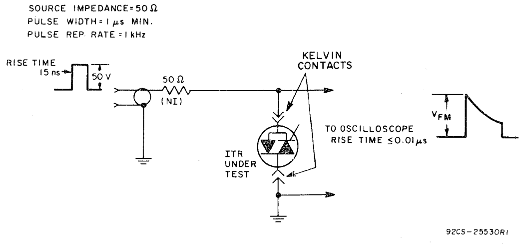


Fig.42 – Test circuit for measurement of peak forward voltage drop at turn-on for rectifier unit of ITR.

DIACS

Voltage-Current Characteristic

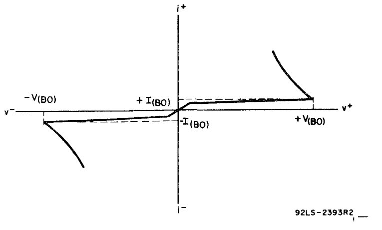
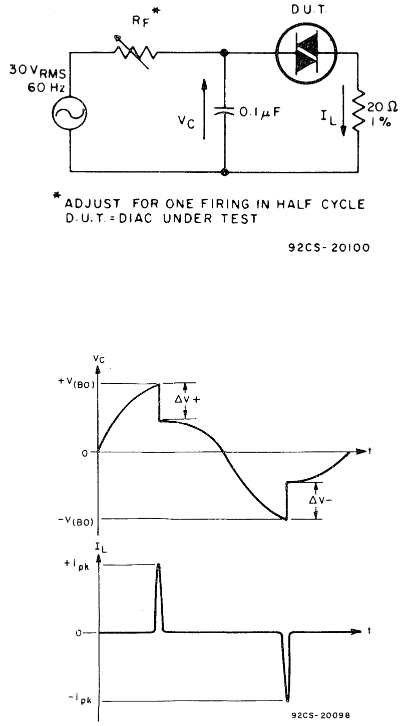


Fig.43 – Voltage-current characteristic for a diac.

Switching Measurements

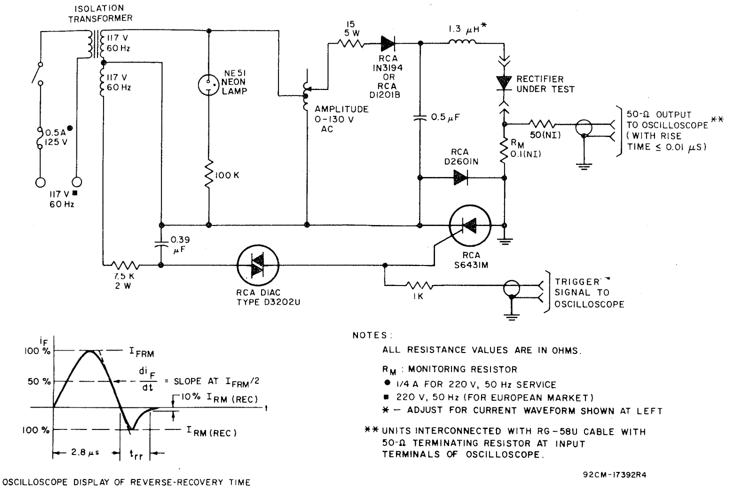


*ADJUST FOR ONE FIRING IN HALF CYCLE
D.U.T. = DIAC UNDER TEST

Fig.44 – Circuit and waveforms used to measure diac characteristics.

RECTIFIERS

Reverse-Recovery-Measurements



NOTES:

ALL RESISTANCE VALUES ARE IN OHMS.

R_M : MONITORING RESISTOR

● 1/4 A FOR 220 V, 50 Hz SERVICE

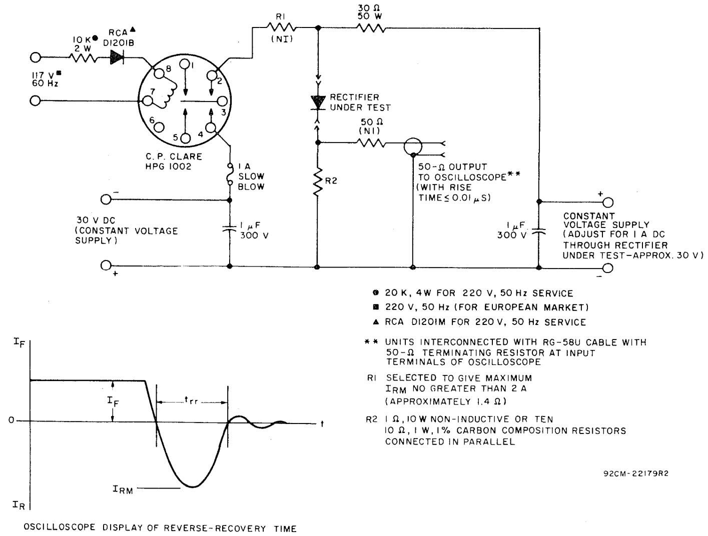
■ 220 V, 50 Hz (FOR EUROPEAN MARKET)

* – ADJUST FOR CURRENT WAVEFORM SHOWN AT LEFT

** UNITS INTERCONNECTED WITH RG-58U CABLE WITH 50-Ω TERMINATING RESISTOR AT INPUT TERMINALS OF OSCILLOSCOPE.

92CM-17392R4

Fig.45 – Test circuit (pulsed sine wave) for measurement of reverse-recovery time.



● 20 K, 4W FOR 220 V, 50 Hz SERVICE

■ 220 V, 50 Hz (FOR EUROPEAN MARKET)

▲ RCA D1201M FOR 220 V, 50 Hz SERVICE

** UNITS INTERCONNECTED WITH RG-58U CABLE WITH 50-Ω TERMINATING RESISTOR AT INPUT TERMINALS OF OSCILLOSCOPE

R1 SELECTED TO GIVE MAXIMUM I_{RM} NO GREATER THAN 2 A (APPROXIMATELY 1.4 Ω)

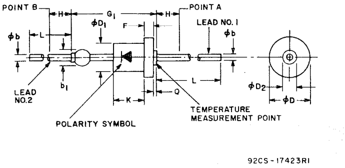
R2 1 Ω, 10 W NON-INDUCTIVE OR TEN 10 Ω, 1 W, 1% CARBON COMPOSITION RESISTORS CONNECTED IN PARALLEL

92CM-22179R2

Fig.46 – Test circuit (pulsed dc) for measurement of reverse-recovery time.

Dimensional Outlines

DO-1/DO-210AA

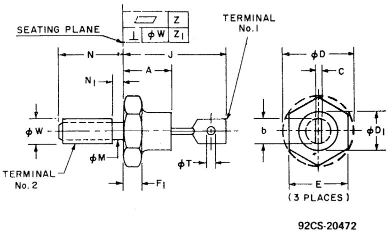


SYMBOL	INCHES MIN.	INCHES MAX.	MILLIMETERS MIN.	MILLIMETERS MAX.	NOTES
ϕb	0.027	0.035	0.69	0.89	2
b_1	–	0.125	–	3.18	1
ϕD	0.360	0.400	9.14	10.16	
ϕD_1	0.245	0.280	6.22	7.11	
ϕD_2	–	0.200	–	5.08	
F	–	0.075	–	1.91	
G_1	–	0.725	–	18.42	
H	0.5	–	12.7	–	
K	0.220	0.260	5.59	6.60	
L	1.000	1.625	25.40	41.28	
Q	–	0.025	–	0.64	

NOTES:

1. Dimensions to allow for pinch or seal deformation anywhere along tubulation (optional).
2. Diameter to be controlled from free end of lead to within 0.188 inch (4.78 mm) from the point of attachment to the body. Within the 0.188 inch (4.78 mm) dimension, the diameter may vary to allow for lead finishes and irregularities.

DO-4/DO-203MA



SYMBOL	INCHES MIN.	INCHES MAX.	MILLIMETERS MIN.	MILLIMETERS MAX.	NOTES
A	–	0.405	–	10.28	
b	–	0.250	–	6.35	2
c	0.020	0.065	0.51	1.65	
ϕD	–	0.505	–	12.82	
ϕD_1	0.265	0.424	6.74	10.76	
E	0.423	0.438	10.75	11.12	
F_1	0.075	0.175	1.91	4.44	1
J	0.600	0.800	15.24	20.32	
ϕM	0.163	0.189	4.15	4.80	
N	0.422	0.453	10.72	11.50	
N_1	–	0.078	–	1.98	
ϕT	0.060	0.095	1.53	2.41	
ϕW	10-32 UNF-2A		10-32 UNF-2A		3
Z	–	0.002	–	0.050	
Z_1	–	0.006	–	0.152	

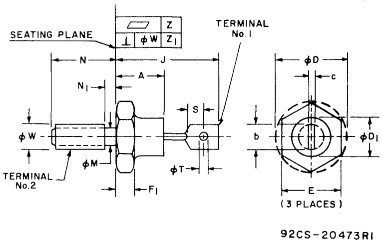
NOTES:

1: Chamfer or undercut on one or both sides of hexagonal base is optional.

2: Angular orientation and contour of Terminal No. 1 is optional.

3: φW is pitch diameter of coated threads. REF: Screw Thread Standards for Federal Services, Handbook H 28 Part I. Recommended torque: 15 inch-pounds.

DO-5/DO-203MB

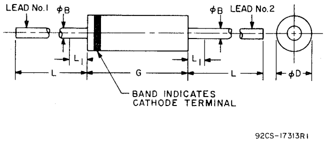


SYMBOL	INCHES MIN.	INCHES MAX.	MILLIMETERS MIN.	MILLIMETERS MAX.	NOTES
A	–	0.450	–	11.43	
b	–	0.375	–	9.52	
c	0.030	0.080	0.77	2.03	
ϕD	–	0.794	–	20.16	
ϕD_1	–	0.667	–	16.94	
E	0.669	0.688	17.00	17.47	
F_1	0.115	0.200	2.93	5.08	
J	0.750	1.000	19.05	25.40	
ϕM	0.220	0.249	5.59	6.32	
N	0.422	0.453	10.72	11.50	
N_1	–	0.090	–	2.28	
S	0.156	–	3.97	–	
ϕT	0.140	0.175	3.56	4.44	
ϕW	1/4-28 UNF 2A		1/4-28 UNF 2A		1
Z	–	0.002	–	0.050	
Z_1	–	0.006	–	0.152	

NOTE

1: φW is pitch diameter of coated threads. REF: Screw-Thread Standards for Federal Services, Handbook H 28 Part I. Recommended torque: 30 inch-pounds.

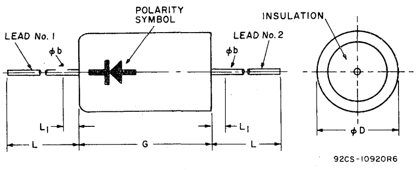
DO-15/DO-204AC



SYMBOL	INCHES MIN.	INCHES MAX.	MILLIMETERS MIN.	MILLIMETERS MAX.
ϕb	0.027	0.035	0.686	0.889
ϕD	0.104	0.140	2.64	3.56
G	0.230	0.300	5.84	7.62
L	1.000	–	25.40	–
L_1*	–	0.050	–	1.27

*Within this zone the diameter may vary to allow for lead finishes and irregularities.

DO-26/DO-204AE

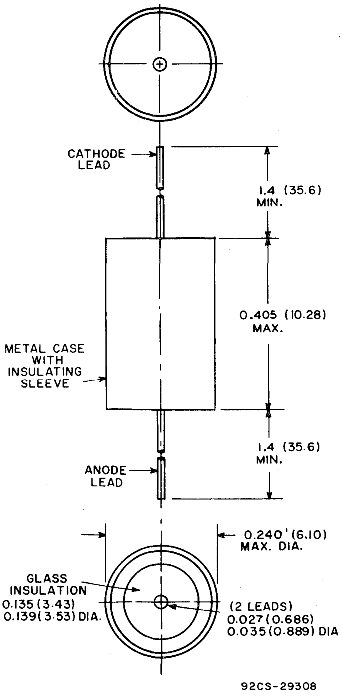


SYMBOL	INCHES MIN.	INCHES MAX.	MILLIMETERS MIN.	MILLIMETERS MAX.	NOTES
ϕb	0.027	0.039	0.69	0.99	
ϕD	0.220	0.260	5.59	6.60	1
G	0.344	0.410	8.74	10.41	1
L	1.400	–	35.56	–	
L_1	–	0.080	–	2.03	2

NOTES:

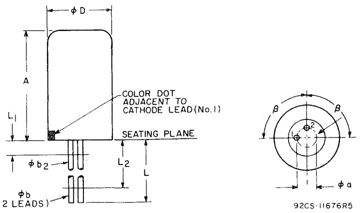
1. Package contour optional within cylinder of diameter, φD, and length, G. Slugs, if any, shall be included within this cylinder but shall not be subject to the minimum limit of φD.
2. Lead diameter not controlled in this zone to allow for flash, lead-finish build up, and minor irregularities other than slugs.

DO-26 with Insulating Sleeve



Dimensional Outlines

Mod. TO-1 2-Lead

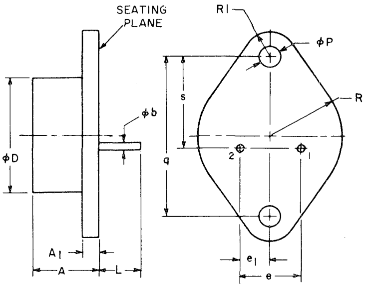


SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
φa	0.061	0.081	1.55	2.06	
A	–	0.410	–	10.41	
φb	–	0.021	–	0.533	1
$φb_2$	0.016	0.019	0.406	0.483	1
φD	–	0.240	–	6.10	
L	1.500	–	38.10	–	1
L_1	–	0.05	–	1.27	
L_2	0.25	–	6.35	–	1
β	90° NOMINAL				

NOTE:

1. $φb_2$ applies between L_1 and L_2. φb applies between L_2 and *1.5 in. (38.10 mm) from seating plane. Diameter is uncontrolled* in L_1 and beyond 1.5 in. (38.10 mm) from seating plane.

TO-3/TO-204MA



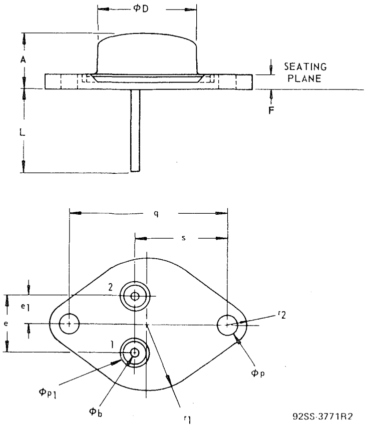
SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.250	0.450	6.4	11.4	
A_1	–	0.135	–	3.42	
φb	0.038	0.043	0.966	1.092	1
φD	–	0.875	–	22.22	
e	0.420	0.440	10.67	11.17	
e_1	0.205	0.225	5.21	5.71	
L	0.312	–	7.93	–	1
φP	0.151	0.161	3.84	4.08	2
q	1.177	1.197	29.90	30.40	
R	–	0.525	–	13.33	
R_1	–	0.188	–	4.77	3
S	0.655	0.675	16.64	17.14	

NOTES:

1. Two pins.
2. Two holes.
3. At both ends

92CS-15222R2

MODIFIED TO-3 (2N5575, 2N5578)

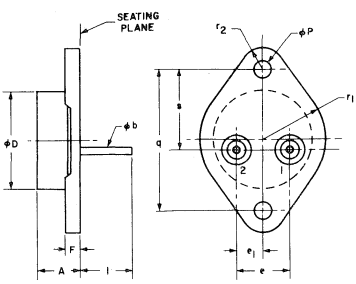


SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.416	0.450	10.57	11.43	
φb	0.059	0.064	1.499	1.626	
φD	0.750	0.771	19.05	19.583	
e	0.420	0.440	10.67	11.18	
e_1	0.205	0.225	5.21	5.72	
F	0.100	0.114	2.54	2.89	
L	0.595	0.625	15.12	15.87	1
φp	0.151	0.161	3.84	4.09	
$φp_1$	0.200	0.285	5.08	7.239	2
q	1.177	1.197	29.90	30.40	
r_1	–	0.525	–	13.34	
r_2	–	0.188	–	4.78	
s	0.655	0.675	16.64	17.15	

NOTES:

1. Two pins.
2. Clearance holes for both pins should be 0.285 in. (7.24 mm) min. dia.

MODIFIED TO-3 (2N6032, 2N6033)



SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.300	0.350	7.62	8.89	
φb	0.059	0.064	1.499	1.626	2
φD		0.800		20.32	
e	0.420	0.440	10.67	11.18	
e_1	0.205	0.225	5.21	5.72	
F		0.114		2.90	
l	0.440	0.470	11.18	11.94	2
φp	0.151	0.161	3.84	4.09	
q	1.177	1.197	29.90	30.40	
r_1		0.525		13.34	
r_2		0.188		4.78	
s	0.655	0.675	16.64	17.15	1

NOTES:

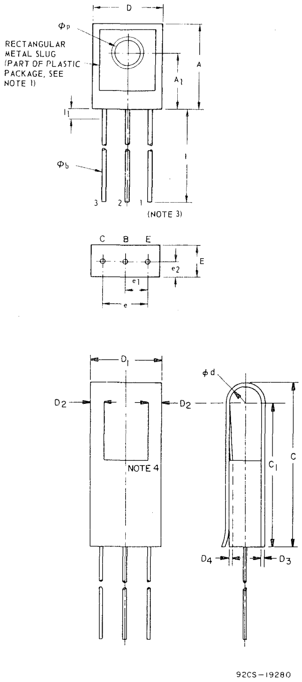
1 THESE DIMENSIONS SHOULD BE MEASURED AT POINTS 0.050" (1.27 mm) TO 0.055" (1.40 mm) BELOW SEATING PLANE. WHEN GAGE IS NOT USED, MEASUREMENT WILL BE MADE AT SEATING PLANE.

2. TWO LEADS.

92CS-17432R1

PLASTIC PACKAGES

PLASTIC TO-5 AND PLASTIC TO-5 WITH HEAT CLIP



SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.385	0.395	9.78	10.03	
A_1	0.251	0.261	6.37	6.63	
φb	0.016	0.019	0.41	0.48	2
C	0.858		21.79		
C_1	0.750		19.05		
D	0.305	0.315	7.75	8.00	
D_1	0.300		7.62		
D_2	0.070		1.77		
D_3	0.0329		0.813		
D_4	0.021	0.041	0.533	1.04	
φd	0.073	0.077	1.85	1.95	
E	0.145	0.155	3.68	3.94	
e	0.195	0.205	4.95	5.21	
e_1	0.095	0.105	2.41	2.67	
e_2	0.070	0.080	1.78	2.03	
ℓ	0.725	0.745	18.41	18.91	
ℓ_1	0.125	0.250	3.17	6.35	
φp	0.112	0.118	2.84	2.99	

NOTE 1: To attach to heat-sink, use a 4-40 binding-head screw and a No. 4 flat washer. The recommended screw torque (for even distribution of mounting pressure and optimum thermal contact) is 6 in.-lb.

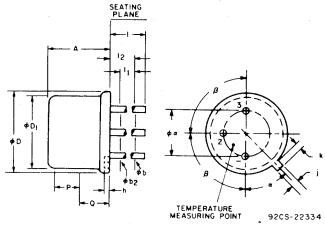
NOTE 2: Three leads. Leads are pretinned to the ℓ_1 dimension.

NOTE 3: Lead numbering from right to left with rectangular metal slug facing observer.

NOTE 4: Tab to be sheared through and set inward as shown.

Dimensional Outlines

TO-5/TO-205MA
TO-39/TO-205MD



SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
φa	0.190	0.210	4.83	5.33	
A	0.240	0.260	6.10	6.60	
φb	0.016	0.021	0.406	0.533	2
φb2	0.016	0.019	0.406	0.483	2
φD	0.350	0.370	8.89	9.40	
φD1	0.305	0.335	8.00	8.51	
h	0.009	0.041	0.229	1.04	
j	0.028	0.034	0.711	0.864	
k	0.029	0.040	0.737	1.02	3
L TO-5	1.500		38.10		2
L TO-39	0.500		12.70		2
l1		0.050		1.27	2
l2	0.250		6.35		2
P	0.100		2.54		1
Q					4
α	45° NOMINAL				
β	90° NOMINAL				

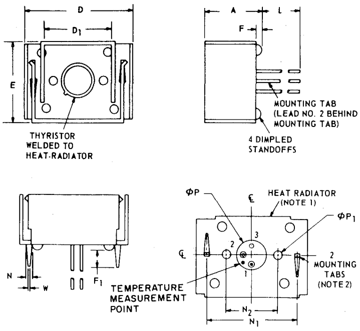
Note 1: This zone is controlled for automatic handling. The variation in actual diameter within this zone shall not exceed 0.010 in. (0.254 mm).

Note 2: (Three leads)φb_2 applies between l_1 and l_2. φb applies between l_2 and l. Diameter is uncontrolled in l_1.

Note 3: Measured from maximum diameter of the actual device.

Note 4: Details of outline in this zone optional.

"Mod. TO-5" with Heat Radiator



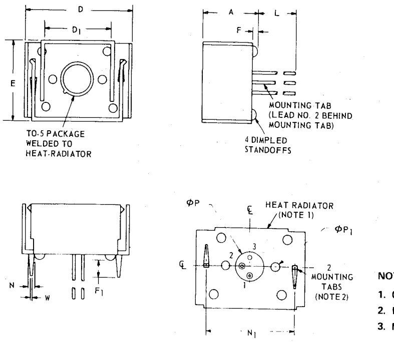
SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	–	.630	–	16.00	
D	1.205	1.235	30.61	31.37	
D1	.745	.755	18.923	19.177	
E	.875	.905	22.22	22.99	
F	.040	.055	1.02	1.40	
F1	.170	.225	4.32	5.72	
L	.920	–	23.37	–	
ΦP	.295	.305	7.493	7.747	
ΦP1	.093	.095	2.362	2.413	
N	.048	.062	1.21	1.57	
N1	.998	1.002	25.349	25.450	3
N2	.687	.689	17.45	17.50	3
W	.048	.052	1.219	1.320	

NOTES:

92LM-2109RI

1. 0.035 C.R.S., finish: electroless nickel plate
2. Recommended hole size for printed-circuit board is 0.070 in. (1.78 mm) dia.
3. Measured at bottom of heat radiator

TO-39/TO-5 with Heat Radiator

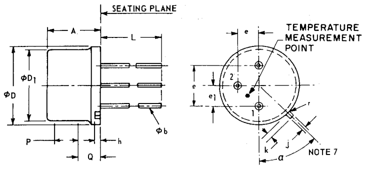


SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	–	0.630	–	16.00	
D	1.205	1.235	30.61	31.37	
D1	0.775	0.785	19.69	19.93	
E	0.875	0.905	22.22	22.99	
F	0.040	0.055	1.02	1.40	
F1	0.160	0.195	4.06	4.95	
L long lead	1.410	–	35.81	–	
L short lead	0.410	–	10.41		
φP	0.295	0.305	7.493	7.747	
φP1	0.093	0.095	2.362	2.413	
N	0.048	0.062	1.21	1.57	
N1	0.998	1.002	25.349	25.450	3
W	0.048	0.052	1.219	1.320	

NOTES:

1. **0.035 C.R.S., finish—electroless nickel plate.**
2. **Recommended hole size for printed-circuit board is** 0.070 in. (1.78 mm) dia.
3. **Measured at bottom of heat-radiator.** 92CS-22335

"Low-Profile TO-5"



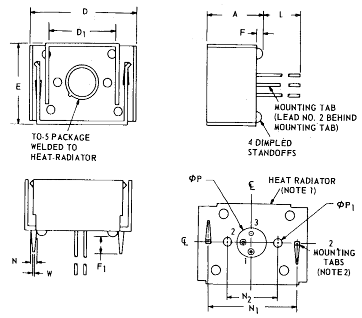
NOTES:

1. This zone is controlled for automatic handling. The variation in actual diameter within the zone shall not exceed .012 in. (.279 mm).
2. (Three Leads) φ b applies between seating plane and 1.015 in. (25.78 mm).
3. Measured from maximum diameter of the actual device.
4. Leads having maximum diameter .021 in. (.533 mm) measured at the seating plane of the device shall be within .007 in. (.178 mm) of their true positions relative to the maximum-width tab.

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	.160	.180	4.06	4.57	
Φb	.017	.021	.432	.533	2
ΦD	.355	.366	9.017	9.296	
ΦD1	.323	.335	8.204	8.51	
e	.190	.210	4.83	5.33	
e1	.100 TRUE POSITION		2.54 TRUE POSITION		4,5
h	.015	.035	.381	.889	
j	.028	.035	.711	.889	5
k	.029	.045	.737	1.14	3,5
L	.985	1.015	25.02	25.78	2
P	.100		2.54		1
Q					6
r		.007		.179	
α	42°	48°			5,7

5. The device may be measured by direct methods or by the gage and gaging procedure described on gage drawing GS-1 of JEDEC publication 12E, May 1964.
6. Details of outline in this zone optional. 92SS-3901R1
7. Tab centerline.

"Low-Profile TO-5" with Heat Radiator

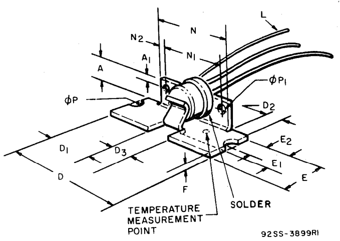


SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	–	.630	–	16.00	
D	1.205	1.235	30.61	31.37	
D1	.745	.755	18.923	19.177	
E	.875	.905	22.22	22.99	
F	.040	.055	1.02	1.40	
F1	.170	.225	4.32	5.72	
L	.885	–	22.48	–	
ΦP	.295	.305	7.493	7.747	
ΦP1	.093	.095	2.362	2.413	
N	.048	.062	1.21	1.57	
N1	.998	1.002	25.349	25.450	3
N2	.687	.689	17.45	17.50	3
W	.048	.052	1.219	1.320	

NOTES:

1. 0.035 C.R.S., finish: electroless nickel plate
2. Recommended hole size for printed-circuit board is 0.070 in. (1.78 mm) dia.
3. Measured at bottom of heat-radiator 92SS-3900R1

"Low-Profile TO-5" with Heat Spreader



NOTES:

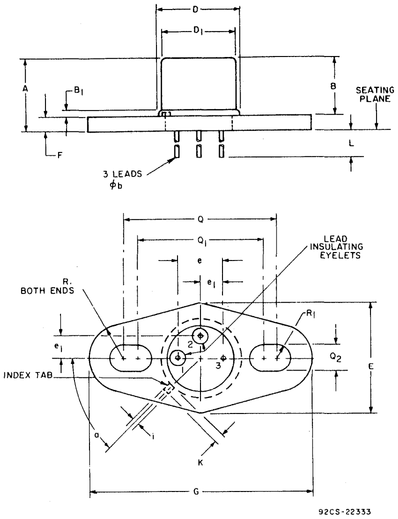
1. Min. length, 3 leads.

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.22		5.58		
A1	0.75		19.05		
D	1.0		25.4		
D1	0.406		10.31		
D2	0.14	0.16	3.55	4.06	
D3	0.188		4.77		
E	0.40		10.16		
E1	0.32		8.12		
E2	0.156		3.96		
F	0.02		0.05		
L	0.95	—	24.13	–	1
N	0.69	0.71	17.52	18.03	
N1	0.55		13.97		
N2	0.75		19.05		
○P	0.072 Rad.		1.83 Rad.		
○P1	0.094 Dia.		2.39 Dia.		2

2. Two holes.

Dimensional Outlines

TO-39/TO-5 with Flange

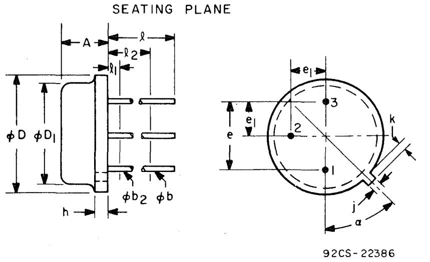


SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	–	0.328	–	8.33	
B	0.240	0.260	6.10	6.60	
B_1	0.009	0.125	0.229	3.18	
φb	0.016	0.019	0.406	0.483	
D	0.335	0.370	8.51	9.40	
D_1	0.305	0.335	7.75	8.51	
E	0.495	0.505	12.57	12.83	
e	0.200 T.P.		5.08 T.P.		1
e_1	0.100 T.P.		2.54 T.P.		1
F	0.062	0.068	1.57	1.74	
G	0.995	1.005	25.27	25.53	
i	0.028	0.034	0.711	0.864	
k	0.029	0.045	0.737	1.14	
L long lead	1.430	–	36.32	–	
L short lead	0.430	–	10.92	–	
Q	0.685	0.691	17.40	17.55	
Q_1	0.559	0.565	14.20	14.35	
Q_2	0.128	0.132	3.25	3.35	
R	0.156 T.P.		3.96 T.P.		1
R_1	0.064	0.066	1.63	1.67	
α	45° T.P.				1, 2

NOTES:

1. True position.
2. Tab centerline.

TO-46/TO-206AB

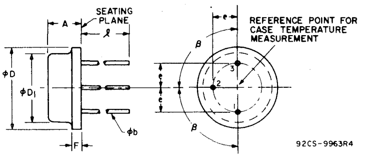


SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.065	0.085	1.65	2.16	
φb	0.016	0.021	0.406	0.533	1
$φb_2$	0.012	0.019	0.305	0.483	1
φD	0.209	0.230	5.31	5.84	
$φD_1$	0.178	0.195	4.52	4.95	
e	0.100 T.P.		2.54 T.P.		2
e_1	0.050 T.P.		1.27 T.P.		2
h		0.040		1.02	
j	0.036	0.046	0.914	1.17	
k	0.028	0.048	0.711	1.22	4
ℓ	0.500		12.70		1
$ℓ_1$		0.050		1.27	1
$ℓ_2$	0.250		6.35		1
α	45° T.P.		45° T.P.		3, 5

NOTES:

1. (THREE LEADS) $φb_2$ APPLIES BETWEEN $ℓ_1$ AND $ℓ_2$. φb APPLIES BETWEEN $ℓ_2$ AND 0.5 IN. (12.70 MM) FROM SEATING PLANE. DIAMETER IS UNCONTROLLED IN $ℓ_1$ AND BEYOND 0.5 IN. (12.70 MM) FROM SEATING PLANE.
2. MAXIMUM DIAMETER LEADS AT A GAGING PLANE 0.054 IN. (1.37 MM) + 0.001 IN. (0.025 MM) - 0.000 IN. (0.000 MM) BELOW SEATING PLANE TO BE WITHIN 0.007 IN. (0.178 MM) OF THEIR POSITION RELATIVE TO MAXIMUM-WIDTH TAB AND TO THE MAXIMUM 0.230 IN. (5.84 MM) DIAMETER MEASURED WITH A SUITABLE GAGE. WHEN GAGE IS NOT USED, MEASUREMENT WILL BE MADE AT SEATING PLANE.
3. INDEX TAB FOR VISUAL ORIENTATION ONLY.
4. MEASURED FROM MAXIMUM DIAMETER OF THE ACTUAL DEVICE.
5. TAB CENTERLINE.

TO-8

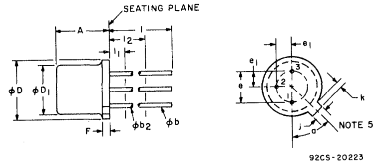


SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.270	0.330	6.86	8.38	–
φb	0.027	0.033	0.686	0.838	1
φD	0.550	0.650	13.97	16.51	–
$φD_1$	0.444	0.524	11.28	13.31	–
e	0.136	0.146	3.45	3.71	–
F	–	0.115	–	2.92	–
ℓ	0.360	0.440	9.14	11.18	1
β	90 NOMINAL				

NOTE:

1. Three leads.

TO-18/TO-206MA

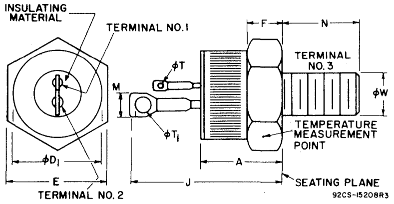


SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.170	0.210	4.32	5.33	
φb	0.016	0.021	0.406	0.533	1
$φb_2$	0.016	0.019	0.406	0.483	1
φD	0.209	0.230	5.31	5.84	
$φD_1$	0.178	0.195	4.52	4.95	
e	0.100 T.P.		2.54 T.P.		2, 4
e_1	0.050 T.P.		1.27 T.P.		2, 4
F		0.030		0.762	
j	0.036	0.046	0.914	1.17	4
k	0.028	0.048	0.711	1.22	3
l	0.500		12.70		1
l_1		0.050		1.27	1
l_2	0.250		6.35		1
α	45° T.P.				5

NOTES:

1. (Three leads) $φb_2$ applies between l_1 and l_2. φb applies between l_2 and 0.5 in. (12.70 mm) from seating plane. Diameter is uncontrolled in l_1 and beyond 0.5 in. (12.70 mm) from seating plane.
2. Leads having maximum diameter 0.019 in. (0.483 mm) measured in gaging plane 0.054 in. (1.37 mm) + 0.001 in. (0.025 mm) – 0.00 in. (0.00 mm) below the seating plane of the device shall be within 0.007 in. (0.178 mm) of their true positions relative to a maximum-width tab.
3. Measured from maximum diameter of the actual device.
4. The device may be measured by direct methods or by the gage and gaging procedure described on gage drawing GS-2.
5. Tab centerline.

TO-48/TO-209MA



NOTE

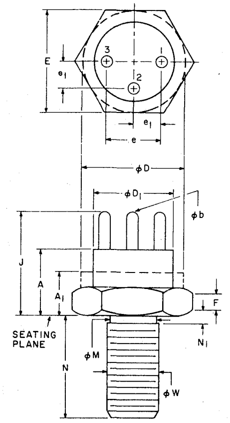
1. φW is pitch diameter of coated threads.

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.330	0.505	8.4	12.8	–
$φD_1$	–	0.544	–	13.81	–
E	0.544	0.562	13.82	14.28	–
F	0.113	0.200	2.87	5.08	–
J	0.950	1.100	24.13	27.94	–
M	0.215	0.225	5.46	5.71	–
N	0.422	0.453	10.72	11.50	–
φT	0.058	0.068	1.47	1.73	–
$φT_1$	0.138	0.148	3.51	3.75	–
φW	1/4-28 UNF-2A		1/4-28 UNF-2A		1

REF: Screw-Thread Standards for Federal Services, Handbook H28, Part I. Recommended Torque: 25 inch-pounds.

Dimensional Outlines

TO-60/TO-212MA



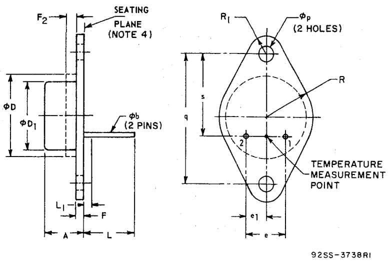
SYMBOL	INCHES MIN.	INCHES MAX.	MILLIMETERS MIN.	MILLIMETERS MAX.	NOTES
A	0.215	0.320	5.46	8.13	
A_1	–	0.165	–	4.19	2
ϕb	0.030	0.046	0.762	1.17	4
ϕD	0.360	0.437	9.14	11.10	2
$ϕD_1$	0.320	0.360	8.13	9.14	
E	0.424	0.437	10.77	11.10	
e	0.185	0.215	4.70	5.46	
e_1	0.090	0.110	2.29	2.79	
F	0.090	0.135	2.29	3.43	1
J	0.355	0.480	9.02	12.19	
ϕM	0.163	0.189	4.14	4.80	
N	0.375	0.455	9.53	11.56	
N_1	–	0.078	–	1.98	
ϕW	0.1658	0.1697	4.212	4.310	3, 5

MILLIMETER DIMENSIONS ARE DERIVED FROM ORIGINAL INCH DIMENSIONS

NOTES:

1. Dimension does not include sealing flanges
2. Package contour optional within dimensions specified
3. Pitch diameter — 10-32 UNF 2A thread (coated)
4. Pin spacing perimts insertion in any socket having a pin-circle diameter of 0.200 in. (5.08 mm) and contacts which will accommodate pins with a diameter of 0.030 in. (0.762 mm) min., 0.046 in. (1.17 mm) max.
5. The torque applied to a 10-32 hex nut assembled on the thread during installation should not exceed 12 inch-pounds.

TO-66/TO-213MA

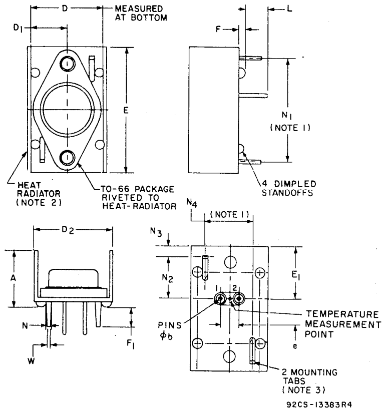


SYMBOL	INCHES MIN.	INCHES MAX.	MILLIMETERS MIN.	MILLIMETERS MAX.	NOTES
A	0.250	0.340	6.35	8.64	
ϕb	0.028	0.034	0.711	0.863	
ϕD	–	0.620	–	15.75	1
$ϕD_1$	0.470	0.500	11.94	12.70	
e	0.190	0.210	4.83	5.33	2
e_1	0.093	0.107	2.36	2.72	2
F_1	0.050	0.075	1.27	1.91	
F_2	–	0.050	–	1.27	1
L	0.360	–	9.14	–	
L_1	–	0.050	–	1.27	3
ϕp	0.142	0.152	3.61	3.86	
q	0.958	0.962	24.33	24.43	
R	–	0.350	–	8.89	
R_1	–	0.145	–	3.68	
s	0.570	0.590	14.48	14.99	

NOTES:

1. Body contour is optional within zone defined by ϕD and F_2.
2. These dimensions should be measured at points 0.050 in. (1.27 mm) to 0.055 in. (1.40 mm) below seating plane. When gage is not used, measurement will be made at seating plane.
3. ϕb applies between L_1 and L. Diameter is uncontrolled in L_1.
4. The seating plane of header shall be flat within 0.001 in. (0.025 mm) concave to 0.004 in. (0.10 mm) convex inside a 0.520 in. (13.21 mm) diameter circle on the center of the header and flat within 0.001 in (0.025 mm) concave to 0.006 in. (0.15 mm) convex overall.

TO-66 with Heat Radiator

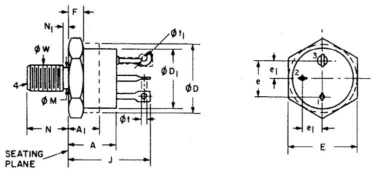


SYMBOL	INCHES MIN.	INCHES MAX.	MILLIMETERS MIN.	MILLIMETERS MAX.	NOTES
A	–	0.620	–	15.75	
ϕb	0.028	0.034	0.711	0.864	
D	0.750	0.760	19.05	19.30	
D_1	0.370	0.385	9.40	9.78	
D_2	0.820	0.920	20.83	23.37	
E	1.297	1.327	32.94	33.70	
E_1	0.546	0.566	13.87	14.37	
e	0.190	0.210	4.83	5.33	
F	0.30	0.55	7.62	13.97	
F_1	0.175	0.210	4.44	5.33	
L	0.270	–	6.86	–	
N	0.052	0.065	1.32	1.65	
N_1	1.098	1.102	27.89	27.99	1
N_2	0.448	0.452	11.38	11.47	
N_3	0.099	0.113	0.25	0.29	
N_4	0.498	0.502	12.65	12.75	
W	0.048	0.060	1.22	1.52	

NOTES:

1. Measured at bottom of heat radiator.
2. 0.035 in. (0.889) C.R.S., tin plated.
3. Recommended hole size for printed-circuit board is 0.070 in. (1.778) dia.

TO-63/TO-211MB



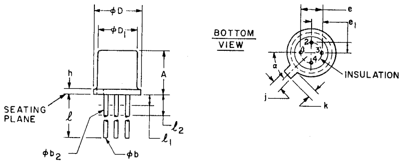
SYMBOL	INCHES MIN.	INCHES MAX.	MILLIMETERS MIN.	MILLIMETERS MAX.	NOTES
A	0.480	0.535	12.19	13.59	
A_1	–	0.300	–	7.62	2
ϕD	0.775	0.875	19.69	22.23	2
$ϕD_1$	0.745	0.775	18.92	19.69	
E	0.855	0.875	21.72	22.23	
e	0.485	0.515	12.32	13.08	5
e_1	0.240	0.260	6.10	6.60	5
F	0.090	0.167	2.29	4.24	1
J	0.937	1.030	23.80	26.16	
ϕM	0.278	0.312	7.06	7.92	
N	0.460	0.495	11.68	12.57	
N_1	–	0.105	–	2.67	
ϕt	0.060	0.105	1.52	2.67	
$ϕt_1$	0.060	0.105	1.52	2.67	4
ϕW	0.2806	0.2854	7.127	7.249	3

92CS-20225

NOTES:

1. DIMENSION DOES NOT INCLUDE SEALING FLANGES.
2. PACKAGE CONTOUR OPTIONAL WITHIN DIMENSIONS SPECIFIED.
3. PITCH DIAMETER - THREAD 5/16-24 UNF-2A (COATED). REFERENCE (SCREW THREAD STANDARDS FOR FEDERAL SERVICES - HANDBOOK H-28).
4. THIS TERMINAL CAN BE FLATTENED AND PIERCED OR HOOK TYPE.
5. POSITION OF LEADS IN RELATION TO THE HEXAGON IS NOT CONTROLLED.

TO-72/TO-206MD



SYMBOL	INCHES MIN.	INCHES MAX.	MILLIMETERS MIN.	MILLIMETERS MAX.	NOTES
A	0.170	0.210	4.32	5.33	
ϕb	0.016	0.021	0.406	0.533	2
$ϕb_2$	0.016	0.019	0.406	0.483	2
ϕD	0.209	0.230	5.31	5.84	
$ϕD_1$	0.178	0.195	4.52	4.95	
e	0.100 T.P.		2.54 T.P.		4
e1	0.050 T.P.		1.27 T.P.		4
h		0.030		0.762	
j	0.036	0.046	0.914	1.17	
k	0.028	0.048	0.711	1.22	3
l	0.500		12.70		2
l_1		0.050		1.27	2
l_2	0.250		6.35		2
α	45° T.P.		45° T.P.		4, 6

92CS-17444R1

Note 1: (Four leads). Maximum number leaus omitted in this outline, "none" (0). The number and position of leads actually present are indicated in the product registration. Outline designation determined by the location and minimum angular or linear spacing of any two adjacent leads.

Note 2: (All leads) $ϕb_2$ applies between l_1 and l_2. ϕb applies between l_2 and 0.50 in. (12.70 mm) from seating plane. Diameter is uncontrolled in l_1 and beyond 0.50 in. (12.70 mm) from seating plane.

Note 3: Measured from maximum diameter of the product.

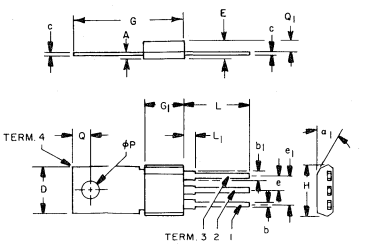
Note 4: Leads having maximum diameter 0.019 in. (0.484 mm) measured in gaging plane 0.054 in. (1.37 mm) +0.001 in. (0.025 mm) – 0.000 (0.000 mm) below the seating plane of the product shall be within 0.007 in. (0.178 mm) of their true position relative to a maximum width tab.

Note 5: The product may be measured by direct methods or by gage.

Note 6: Tab centerline.

Dimensional Outlines

TO-202AB
RCP Plastic Package
(VERSATAB)



SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	–	0.05	–	1.270	1
b	0.023	0.029	0.584	0.736	
b_1	0.045	0.055	1.143	1.397	1
c	0.018	0.026	0.457	0.660	
D	0.305	0.325	7.747	8.255	
E	0.130	0.150	3.302	3.810	
e	0.095	0.105	2.413	2.667	
e_1	0.190	0.210	4.826	5.334	
F	–	0.08	–	2.032	1
G	0.760	0.840	19.31	21.33	
G_1	0.230	0.250	5.842	6.350	
H	0.330	0.370	8.382	9.398	
L	0.400	0.450	10.16	11.43	
L_1	0.050	0.100	1.27	2.54	1,2
ϕP	0.123	0.127	3.124	3.225	
Q	0.120	0.130	3.048	3.302	
Q_1	0.039	0.050	0.990	1.270	
α_1	–	50°	–	50°	1

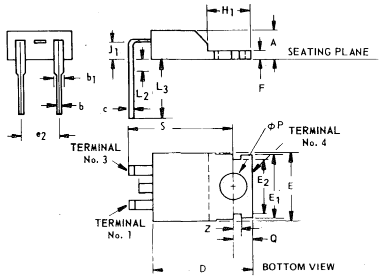
TEMPERATURE MEASUREMENT: 92CS-24062R2

1/16 in. (1.58 mm) from plastic encapsulment on either mounting flange (terminal No. 4) or anode lead (terminal No. 2).

NOTES:

1. Package contour optional within dimensions specified.
2. Lead dimensions uncontrolled in this zone.
3. Chamfer on tab optional.
4. Controlling dimensions: inch.

TO-220AA
VERSAWATT



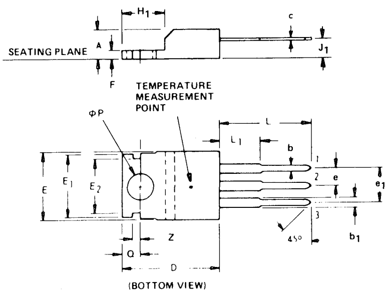
SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.140	0.190	3.56	4.82	–
b	0.020	0.045	0.51	1.14	–
b_1	0.045	0.070	1.14	1.77	–
c	0.015	0.025	0.38	0.63	–
D	0.560	0.625	14.23	15.87	–
E	0.380	0.420	9.66	10.66	1
E_1	0.365	0.385	9.28	9.77	–
E_2	0.300	0.320	7.62	8.12	–
e_2	0.190	0.210	4.83	5.33	2
F	0.045	0.055	1.14	1.39	–
H_1	0.230	0.270	5.85	6.85	1
J_1	0.080	0.115	2.04	2.92	–
L_2	–	0.050	–	1.27	–
L_3	0.360	0.422	9.15	10.71	–
ϕP	0.139	0.147	3.531	3.733	–
Q	0.100	0.120	2.54	3.04	–
S	0.580	0.610	14.74	15.49	–
Z	0.040	0.060	1.02	1.52	–

92CS-17990R2

NOTES:

1. Tab contour optional within H_1 and E.
2. Position of lead to be measured 0.050 – 0.055 in. (1.270 – 1.397 mm) below seating plane.

TO-220AB
VERSAWATT



SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.140	0.190	3.56	4.82	–
b	0.020	0.045	0.51	1.14	–
b_1	0.045	0.070	1.14	1.77	–
c	0.015	0.025	0.38	0.63	–
D	0.560	0.625	14.23	15.87	–
E	0.380	0.420	9.66	10.66	1
E_1	0.365	0.385	9.28	9.77	–
E_2	0.300	0.320	7.62	8.12	–
e	0.090	0.110	2.29	2.79	2
e_1	0.190	0.210	4.83	5.33	2
F	0.045	0.055	1.14	1.39	–
H_1	0.230	0.270	5.85	6.85	1
J_1	0.080	0.115	2.04	2.92	–
L	0.500	0.562	12.70	14.27	–
L_1	–	0.250	–	6.35	–
ϕP	0.139	0.147	3.531	3.733	–
Q	0.100	0.120	2.54	3.04	–
Z	0.040	0.060	1.02	1.52	–

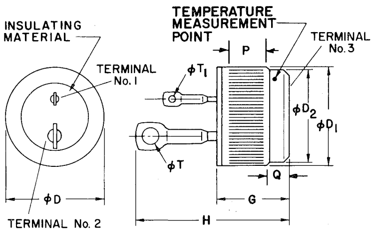
92SS-17991R2

NOTES:

1. Tab contour optional within H_1 and E.
2. Position of lead to be measured 0.250 – 0.255 in. (6.350 – 6.477 mm) from case.

TO-203AA

Press-Fit
6-, 10-, and 15-A Triacs; 20- and 35-A SCR's



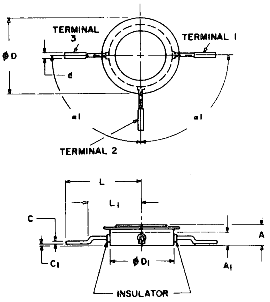
SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
ϕD	–	0.510	–	12.95	1
ϕD_1	0.501	0.505	12.726	12.827	2
ϕD_2	0.465	0.475	11.82	12.06	
G	0.330	0.380	8.39	9.65	
H	–	0.800	–	20.32	
P	0.100	–	2.54	–	2
Q	0.080	0.097	–	–	
ϕT	0.065	0.090	1.66	2.28	3,4
ϕT_1	0.035	0.068	0.89	1.72	

NOTES:

1. Outline contour is optional within zone defined by ϕD and G min. and H max.
2. Straight knurl surface.
3. Elongated hole in terminal is optional.
4. Contour and orientation of terminal 1 and terminal 2 are not defined.
5. Terminal 1 to be shorter than terminal 2 for identification.

92CS-23134R1

RADIAL PACKAGE



SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	–	0.200	–	5.08	
A_1	–	0.125	–	3.17	1
C	0.015	0.019	0.38	0.48	
C_1	–	0.015	–	0.38	
ϕD	–	0.710	–	18.03	
ϕD_1	0.615	0.690	15.62	17.52	1
d	0.042	0.046	1.06	1.16	
L	–	0.705	–	17.90	
L_1	–	0.510	–	12.95	
α_1	90° ± 2°		90° ± 2°		

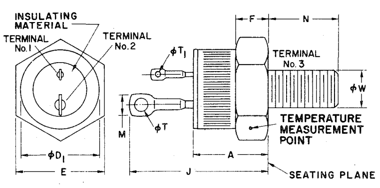
92CS- 20224

NOTE:

1. CONTROLLED AREA OF THE DIAMETER DOES NOT INCLUDE THE BRAZED AREA AROUND THE CERAMIC AND TERMINAL 2.

Dimensional Outlines

Stud 6-, 10, and 15-A Triacs; 20- and 35-A SCR's

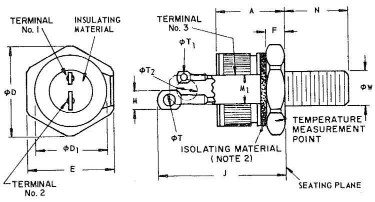


SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.330	0.505	8.40	12.80	
ϕD_1	–	0.544	–	13.81	
E	0.544	0.562	13.82	14.28	
F	0.113	0.200	2.87	5.08	
J	–	0.950	–	24.13	
M	–	0.155	–	3.94	
N	0.422	0.453	10.72	11.50	
ϕT_1	0.058	0.068	1.47	1.73	
ϕT	0.080	0.090	2.03	2.29	
ϕW	1/4-28 UNF-2A		1/4-28 UNF-2A		1

NOTE. 1.
ϕW is pitch diameter of coated threads.
REF: Screw-Thread Standards for Federal Services, Handbook H28,
Part I. Recommended Torque: 35 in-lbf (0.4 kg f-m)
Maximum Torque: 50 in-lb (0.57 kg f-m)

92CS-23135

Isolated-Stud 6-, 10-, and 15-A Triacs; 20- and 35-A SCR's



SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	–	0.673	–	17.09	
ϕD	0.604	0.614	15.34	15.59	
ϕD_1	0.501	0.505	12.72	12.82	
E	0.551	0.557	13.99	14.14	
F	0.175	0.185	4.44	4.69	
J	–	1.055	–	26.79	
M	–	0.155	–	3.94	
M_1	0.200	0.210	5.08	5.33	
N	0.422	0.452	10.72	11.48	
ϕT_1	0.058	0.068	1.47	1.73	
ϕT	0.080	0.090	2.03	2.29	
ϕT_2	0.138	0.148	3.50	3.75	
ϕW	1/4-28 UNF-2A		1/4-28 UNF-2A		1

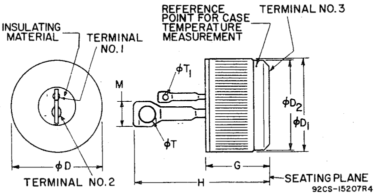
NOTES:

92CS-23133RI

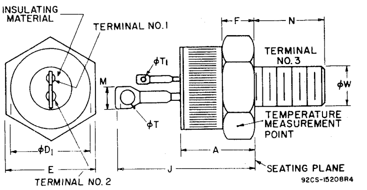
1. ϕW is pitch diameter of coated threads.
   REF: Screw-Thread Standards for Federal Services, Handbook H28,
   Part I. Recommended Torque: 35 in-lbf (0.4 kg f-m)
   Maximum Torque: 50 in-lb (0.57 kg f-m)
2. Isolating material (ceramic) between hex (stud) and terminal No. 3 is beryllium oxide. Minimum isolation breakdown voltage is 2100 V rms for 1 minute duration.

WARNING: The ceramic used in these packages contains beryllium oxide. Do not crush, grind, or abrade these portions because the dust resulting from such action may be hazardous if inhaled. Disposal should be by burial.

Press-Fit
25-, 30-, and 40-A Triacs



Stud 25-, 30-, and 40-A Triacs

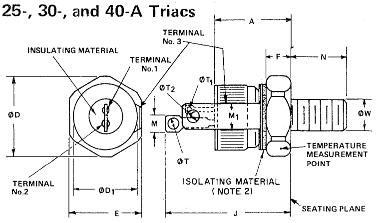


SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.330	0.505	8.4	12.8	–
ϕD_1	–	0.544	–	13.81	–
E	0.544	0.562	13.82	14.28	–
F	0.113	0.200	2.87	5.08	–
J	0.950	1.100	24.13	27.94	–
M	0.215	0.225	5.46	5.71	–
N	0.422	0.453	10.72	11.50	–
ϕT_1	0.058	0.068	1.47	1.73	–
ϕT	0.138	0.148	3.50	3.75	–
ϕW	1/4-28 UNF-2A		1/4-28 UNF-2A		1

NOTE

1. ϕW is pitch diameter of coated threads.
   REF: Screw-Thread Standards for Federal Services, Handbook H28,
   Part I. Recommended Torque: 35 in-lbf (0.4 kg f-m).
   Maximum Torque: 50 in-lbf (0.57 kg f-m)

Isolated-Stud
25-, 30-, and 40-A Triacs



SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	–	0.673	–	17.09	–
ϕD	0.604	0.614	15.34	15.59	–
ϕD_1	0.501	0.505	12.72	12.82	–
E	0.551	0.557	13.99	14.14	–
F	0.175	0.185	4.44	4.69	–
J	–	1.298	–	32.96	–
M	0.210	0.230	5.33	5.84	–
M_1	0.200	0.210	5.08	5.33	–
N	0.422	0.452	10.72	11.48	–
ϕT_1	0.058	0.068	1.47	1.73	–
ϕT	0.138	0.148	3.50	3.75	–
ϕT_2	0.138	0.148	3.50	3.75	–
ϕW	¼-28 UNF-2 A		¼-28 UNF-2 A		1

NOTES:

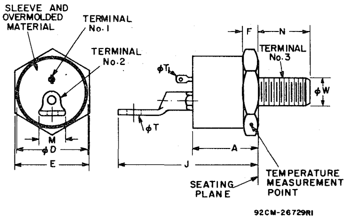
92CS-29311

1. ϕW is pitch diameter of coated threads.
   REF: Screw-Thread Standards for Federal Services, Handbook H28,
   Part I. Recommended Torque: 35 in-lbf (0.4 kg f-m)
   Maximum Torque: 50 in-lb (0.57 kg f-m)
2. Isolating material (ceramic) between hex (stud) and terminal No. 3 is beryllium oxide. Minimum isolation breakdown voltage is 2100 V rms for 1 minute duration.

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
G	–	0.380	–	9.65	–
ϕD	0.501	0.510	12.73	12.95	–
ϕD_1	–	0.505	–	12.83	1
ϕD_2	0.465	0.475	11.81	12.07	–
H	0.825	1.000	20.95	25.40	–
M	0.215	0.225	5.46	5.71	–
ϕT_1	0.058	0.068	1.47	1.73	–
ϕT	0.138	0.148	3.51	3.75	–

NOTE:
1. Outer diameter of knurled surface.

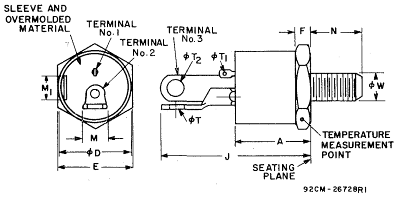
Overmold
Stud 60-A and 80-A Triacs



SYMBOL	INCHES		MILLIMETERS		NOTE
	MIN.	MAX.	MIN.	MAX.	
A	0.7	0.8	17.78	20.32	
ϕD	0.9	1.1	22.86	27.94	
E	1.050	1.060	26.67	26.92	
F	0.175	0.192	4.44	4.88	
J	–	1.75	–	44.45	
M	0.37	0.39	9.40	9.91	
N	0.73	0.77	18.54	19.56	
ϕT_1	0.060	0.065	1.52	1.65	
ϕT	0.19	0.21	4.83	5.33	
ϕW	½–20	NF–2A	½–20	NF–2A	1

1. ϕW is pitch diameter of coated threads. REF: Screw-Thread Standards for Federal Services, Handbook H28, Part I. Recommended torque: 125 in-lb (1.44 kgf-m). Maximum torque: 150 in-lb (1.73 kgf-m).

Overmold
Isolated-Stud 60-A and 80-A Triacs

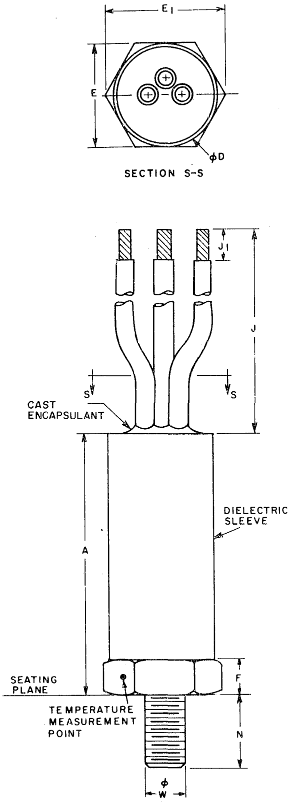


SYMBOL	INCHES		MILLIMETERS		NOTE
	MIN.	MAX.	MIN.	MAX.	
A	0.8	1.0	20.32	25.4	
ϕD	0.9	1.1	22.86	27.94	
E	1.050	1.060	26.67	26.92	
F	0.175	0.192	4.44	4.88	
J	–	1.9	–	48.26	
M	0.37	0.39	9.40	9.91	
M_1	0.37	0.39	9.40	9.91	
N	0.73	0.77	18.54	19.56	
ϕT_1	0.060	0.065	1.52	1.65	
ϕT	0.19	0.21	4.83	5.33	
ϕT_2	0.19	0.21	4.83	5.33	
ϕW	½–20	NF–2A	½–20	NF–2A	1

1. ϕW is pitch diameter of coated threads. REF: Screw-Thread Standards for Federal Services, Handbook H28, Part I. Recommended torque: 125 in-lb (1.44 kgf-m). Maximum torque: 150 in-lb (1.73 kgf-m).
2. Isolating material (ceramic) between hex (stud) and terminal No. 3 is beryllium oxide.

Dimensional Outlines

Press-Fit with Flexible Leads, Encapsulated on Isolated-Stud



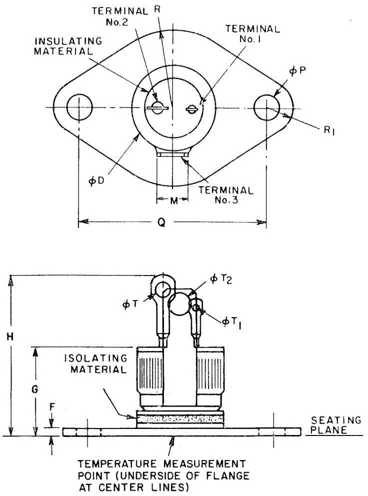
Symbol	INCHES		MILLIMETERS		Note
	Min.	Max.	Min.	Max.	
A	1.498	1.622	38.05	41.20	
ϕD	0.619	0.629	15.72	15.98	
E	0.677	0.683	17.20	17.35	
E_1	0.745	0.755	18.92	19.17	
F	0.117	0.123	2.97	3.12	
J	–	6.500	–	165.10	
J_1	0.125	0.500	3.17	12.70	
N	0.430	0.450	10.92	11.43	
ϕW	1/4-28	UNF-2A	1/4-28	UNF-2A	1

Note 1: ϕW is pitch diameter of coated threads.
Ref.: Screw-Thread Standard for Federal Services Handbook H28, Part I.
Recommended torque: 35 in.-lbf (0.4 kgf m).

92CM-26375

WARNING: The ceramic used in these packages contains beryllium oxide. Do not crush, grind, or abrade these portions because the dust resulting from such action may be hazardous if inhaled. Disposal should be by burial.

Press Fit, Isolated on TO-3 Flange For SCR's and triacs For 25-A, 30-A, and 40-A triacs—see Notes 1 and 2



TEMPERATURE MEASUREMENT POINT (UNDERSIDE OF FLANGE AT CENTER LINES)

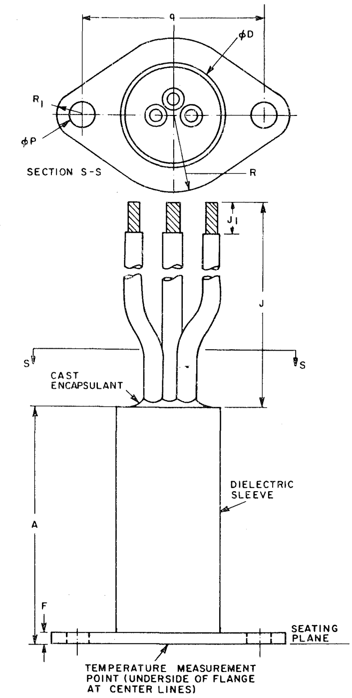
92CM-26377R2

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
G	–	0.635	–	16.13	
ϕD	–	0.510	–	12.95	
F	0.060	0.065	1.52	1.65	
H	–	1.015	–	25.78	
M	0.200	0.210	5.08	5.33	
Q	1.184	1.190	30.07	30.22	
ϕP	0.152	0.159	3.86	4.04	
R	0.497	0.503	12.62	12.77	
R_1	0.169	0.176	4.29	4.47	
ϕT	0.065	0.090	1.66	2.28	1
ϕT_1	0.035	0.068	0.89	1.72	2
ϕT_2	0.138	0.148	3.50	3.76	

NOTES:

1. For 25-A, 30-A, and 40-A triacs, ϕT = 0.138–0.148 in. (3.50–3.75 mm)
2. For 25-A, 30-A, and 40-A triacs, ϕT_1 = 0.058–0.068 in. (1.47 – 1.73 mm)

Press-Fit with Flexible Leads, Encapsulated, Isolated on TO-3 Flange

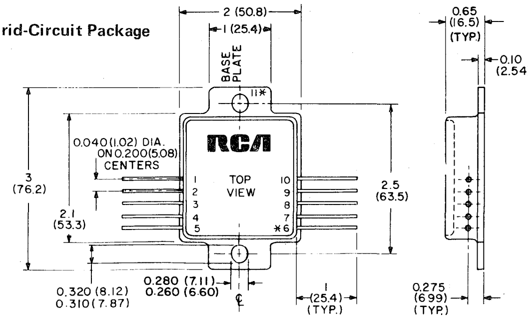


TEMPERATURE MEASUREMENT POINT (UNDERSIDE OF FLANGE AT CENTER LINES)

Symbol	INCHES		MILLIMETERS	
	Min.	Max.	Min.	Max.
A	1.470	1.535	37.34	38.99
ϕD	0.619	0.629	15.72	15.98
F	0.060	0.065	1.52	1.65
J	–	6.500	–	165.10
J_1	0.125	0.500	3.17	12.70
q	1.184	1.190	30.07	30.22
ϕP	0.152	0.159	3.86	4.04
R	0.497	0.503	12.62	12.77
R_1	0.169	0.176	4.29	4.47

92CM-26376

Hybrid-Circuit Package



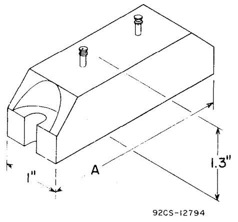
DIMENSIONS IN INCHES AND MILLIMETERS (VALUES IN PARENTHESES)

92CS-27779

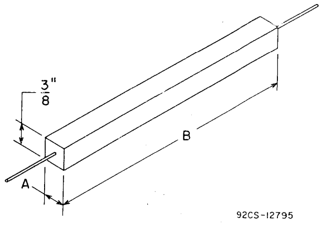
*For HC2000H, Terminal 11 is internally connected to Terminal 6.
For HC2500, Terminal 11 is electrically isolated from internal circuitry.

Dimensional Outlines

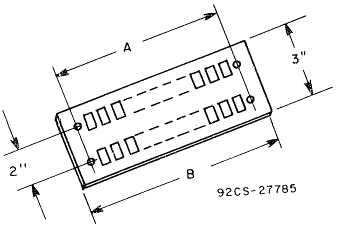
HIGH-VOLTAGE AND BRIDGE RECTIFIER ASSEMBLIES



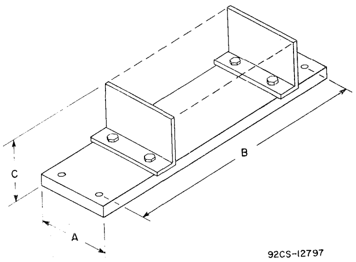
RCA Type No.	Dimensions Inches A
CR101	2-3/8
CR102	2-3/8
CR103	2-3/8
CR104	3-1/4
CR105	3-1/4
CR106	4-1/2
CR107	4-1/2
CR108	4-1/2
CR109	5-1/2
CR110	5-1/2



RCA Type No.	Dimensions Inches A	B
CR201	3/8	2
CR203	3/8	3-1/2
CR204	3/8	4-1/2
CR206	3/4	3-1/2
CR208	3/4	3-1/2
CR210	3/4	4-1/2
CR212	3/4	4-1/2



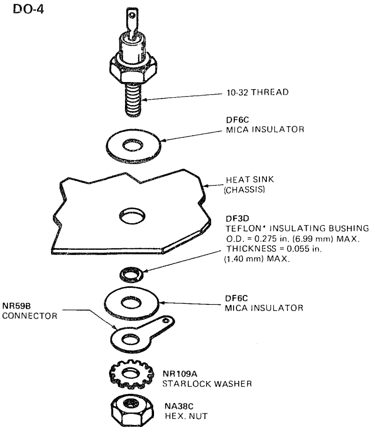
RCA Type No.	Dimensions Inches A	B
CR601	13-3/8	13-7/8
CR602	13-3/8	13-7/8
CR603	20	20-1/2



RCA Type No.	Dimensions Inches A	B	C
CR301	2-1/4	5-1/4	2
CR302	2-1/4	7	2
CR303	2-1/4	8-3/4	2
CR304	2-1/4	10-1/2	2
CR305	2-1/4	12-1/4	2
CR306	2-1/4	14	2
CR307	2-1/4	15-3/4	2
CR311	2-1/4	5-1/4	2
CR312	2-1/4	7	2
CR313	2-1/4	8-3/4	2
CR314	2-1/4	10-1/2	2
CR315	2-1/4	12-1/4	2
CR316	2-1/4	14	2
CR317	2-1/4	15-3/4	2
CR321	3	7-1/8	3-3/8
CR322	3	9-1/2	3-3/8
CR323	3	11-7/8	3-3/8
CR324	3	14-1/4	3-3/8
CR325	3	16-5/8	3-3/8
CR331	3	7-1/8	3-3/8
CR332	3	9-1/2	3-3/8
CR333	3	11-7/8	3-3/8
CR334	3	14-1/4	3-3/8
CR335	3	16-5/8	3-3/8
CR341	5-1/2	7-11/16	5-3/8
CR342	5-1/2	10-1/4	5-3/8
CR343	5-1/2	12-13/16	5-3/8
CR344	5-1/2	15-3/8	5-3/8
CR351	5-1/2	7-11/16	5-3/8
CR352	5-1/2	10-1/4	5-3/8
CR353	5-1/2	12-13/16	5-3/8
CR354	5-1/2	15-3/8	5-3/8
CR401	2-1/4	5-1/4	2
CR402	2-1/4	5-1/4	2
CR403	2-1/4	8-3/4	2
CR404	3	7-1/8	3-3/8
CR405	3	7-1/8	3-3/8
CR406	3	11-7/8	3-3/8
CR407	5-1/2	7-11/16	5-3/8
CR408	5-1/2	7-11/16	5-3/8
CR409	5-1/2	12-13/16	5-3/8
CR501	2-1/4	7	2
CR502	2-1/4	7	2
CR503	3	9-1/2	3-3/8
CR504	3	9-1/2	3-3/8
CR505	5-1/2	10-1/4	5-3/8
CR506	5-1/2	10-1/4	5-3/8

Suggested Hardware and Mounting Arrangements

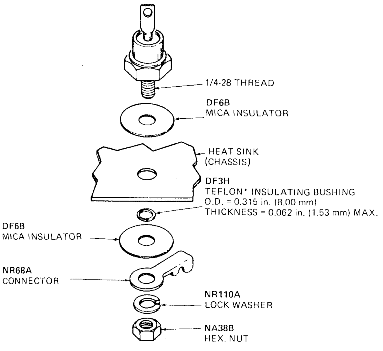
DO-4



* REGISTERED TRADEMARK OF E. I. DUPONT DE NEMOUR & CO.

Maximum torque: 25 in.-lb (0.29 kgf-m)

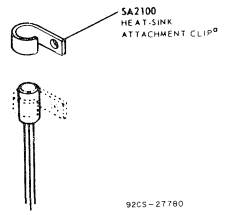
DO-5



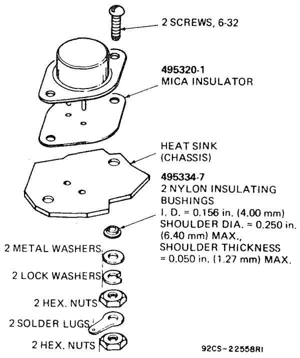
* REGISTERED TRADEMARK OF E. I. DUPONT DE NEMOUR & CO.

Maximum torque: 50 in.-lb (0.58 kgf-m)

TO-1



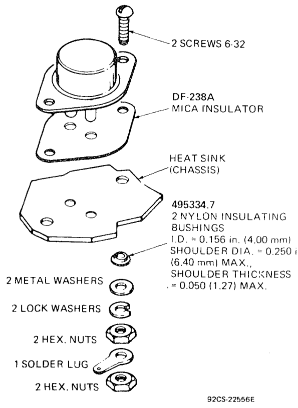
TO-3



NOTE: MAXIMUM TORQUE APPLIED TO MOUNTING FLANGE IS 12 in.-lbs. (0.14 kgf m).

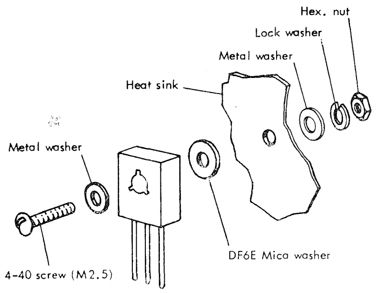
Note: Maximum torque applied to mounting flange is 12 in-lb (0.14 kgf-m).

MODIFIED TO-3



Note: Maximum torque applied to mounting flange is 12 in-lb (0.14 kgf-m).

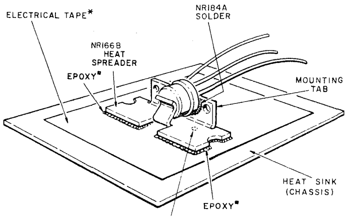
PLASTIC TO-5



Recommended torque (for even distribution of mounting pressure and optimum thermal contact): 6 lbs. in (0.07 kgf-m).

92CS-27783

"LOW - Profile TO-5" with Heat Spreader



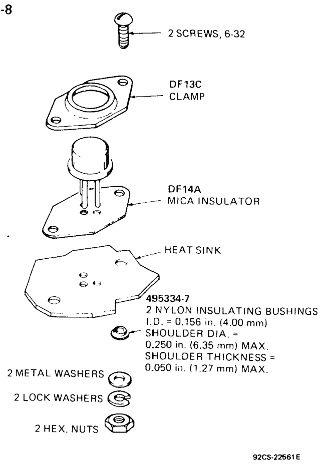
REFERENCE POINT FOR TEMPERATURE MEASUREMENT ▲ (TOTAL THERMAL RESISTANCE FROM JUNCTION TO HEAT SINK = 10 °C/W)

* Scotch brand electrical tape No.27 (thermo setting one side), Minnesota Mining & Mfg. Co., St Paul, Minnesota, or equivalent.

■ An epoxy such as Hysol Epoxy Patch Kit 6C, Hysol Corporation, Olean, N. Y. 14761, or equivalent.

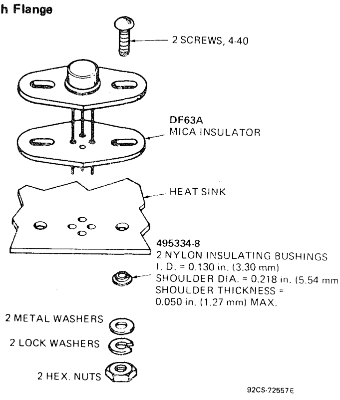
▲ For heat-sink temperature measurement, the thermocouple (wire no larger than AWG No. 26) should be inserted in a small, shallow hole drilled in (but not through) the heat sink at the indicated temperature reference point.

TO-8



Note: Maximum torque applied to mounting flange is 12 in-lb (0.14 kgf-m).

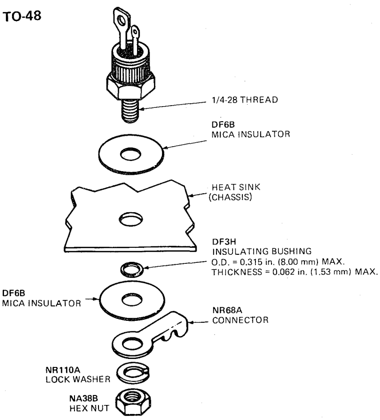
TO-39/TO-5
With Flange



Note: Maximum torque applied to mounting flange is 8 in-lb (0.09 kgf-m).

Suggested Hardware and Mounting Arrangements

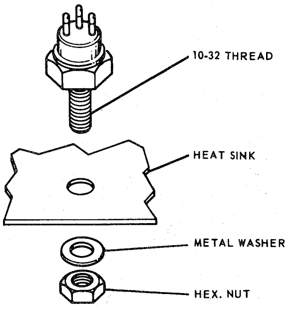
TO-48



Maximum torque: 50 in.-lb (0.58 kgf-m)

92CS-22640R1

TO-60

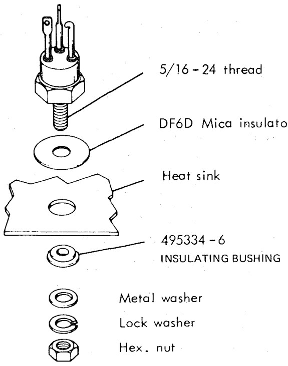


Maximum torque: 12 in.-lb (0.14 kgf-m)

(d)

92CS-26378

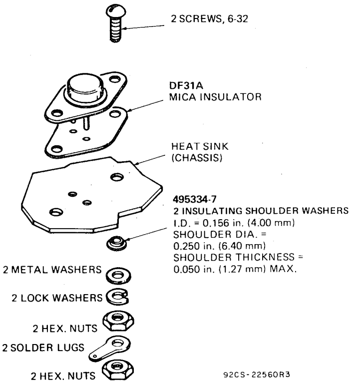
TO-63



Maximum torque: 30 lbf in (0.35 kgf m)

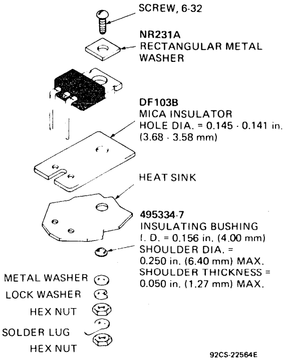
92CS-27781

TO-66



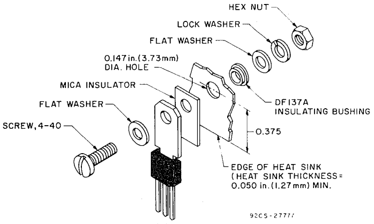
NOTE: MAXIMUM TORQUE APPLIED TO MOUNTING FLANGE IS 12 in. lb. (0.14 kgf m)

TO-220AA



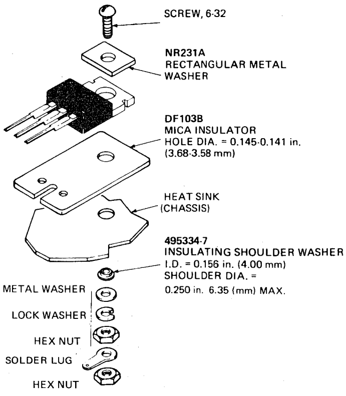
Note: Maximum torque applied to mounting flange is 8 in-lb (0.09 kgf-m).

TO-202AB



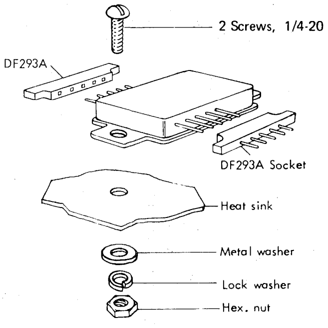
NOTE: Maximum torque qpplied to mounting flange is 8 in.-lb (0.09 kgf-m)

TO-220AB



NOTE: MAXIMUM TORQUE APPLIED TO MOUNTING FLANGE IS 8 in. lb. (0.09 kgf m)

Power Hybrid Circuit Package



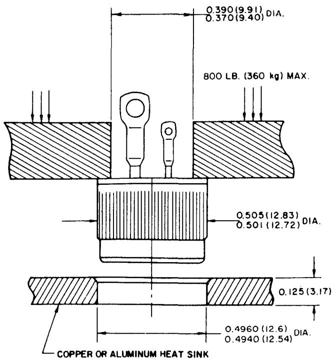
Note: Maximum torque applied to mounting flange is 24 in-lb (0.3 kgf-m).

DF293A is a socket to enable simple connection of this module

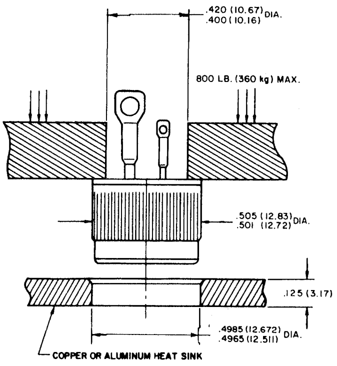
92CS-27782

Suggested Hardware and Mounting Arrangements

Press-Fit (PF-1)
6-, 10-, and 15-A Triacs, 20- and 35-A SCR's

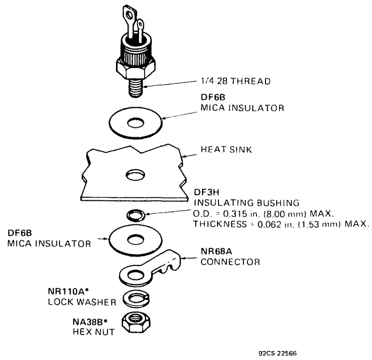


Press-Fit (PF-2)
25-, 30-, and 40-A Triacs



NOTE: Dimensions in parentheses are in millimeters.

Stud and Isolated-Stud
Triacs and SCR's except 60- and 80-A Triacs



* Only hardware required for isolated-stud package

Maximum torque: 50 in.-lb (0.58 kgf-m)

Case-to-Heat Sink Thermal Resistance for Different Mounting Arrangements—Triacs and SCR's except 60- and 80-A Triacs

Package	Type of Mounting Employed	Thermal Resistance-°C/W
Press-Fit	Press-fitted into heat sink. Minimum required thickness of heat sink = 1/8 in. (3.17 mm).	0.5
	Soldered directly to heat sink. (60-40 solder which has a melting point of 188°C should be used. Heating time should be sufficient to cause solder to flow freely).	0.1 to 0.35

Press-Fit
Triacs and SCR's except 60- and 80-A Triacs

MOUNTING CONSIDERATIONS

Mounting of press-fit package types depends upon an interference fit between the thyristor case and the heat sink. As the thyristor is forced into the heat-sink hole, metal from the heat sink flows into the knurl voids of the thyristor case. The resulting close contact between the heat sink and the thyristor case assures low thermal and electrical resistances.

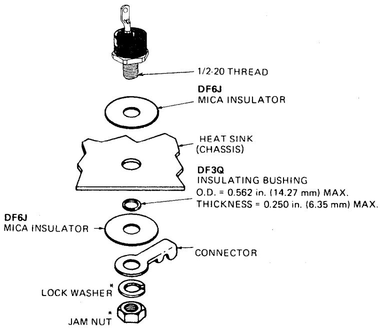
A recommended mounting method, Press-Fit (PF-1) or Press-Fit (PF-2), shows press-fit knurl and heat-sink hole dimensions. If these dimensions are maintained, a "worst-case" condition of 0.0085 in. (0.2159 mm) interference fit will allow press-fit insertion below the maximum allowable insertion force of 800 pounds. A slight chamfer in the heat-sink hole will help center and guide the press-fit package properly into the heat sink. The insertion tool should be a hollow shaft having an inner diameter of 0.380 ± 0.010 in. (9.65 ± 0.254 mm) for PF-1 package, and 0.410 ± 0.010 in. (10.41 ± 0.254 mm) for PF-2 package and an outer diameter of 0.500 in (12.70 mm). These dimensions provide sufficient clearance for the leads and assure that no direct force will be applied to the glass seal of the thyristor.

The press-fit package is not restricted to a single mounting arrangement; direct soldering and the use of epoxy adhesives have been successfully employed. The press-fit case is tin-plated to facilitate direct soldering to the heat sink. A 60-40 solder should be used and heat should be applied only long enough to allow the solder to flow freely.

Case-to-Heat Sink Thermal Resistance for Different Mounting Arrangements—Triacs and SCR's except 60- and 80-A Triacs

Package	Type of Mounting Employed	Resistance-°C/W
Stud & Isolated-Stud	Directly mounted on heat sink with or without the use of heat-sink compound.	0.6
Stud	Mounted on heat sink with a 0.004 to 0.006 in. (0.102 to 0.152 mm) thick mica insulating washer used between unit and heat sink.	
	Without heat sink compound	2.5
	With heat sink compound	1.5

Overmold
Stud and Isolated-Stud
60- and 80-A Triacs



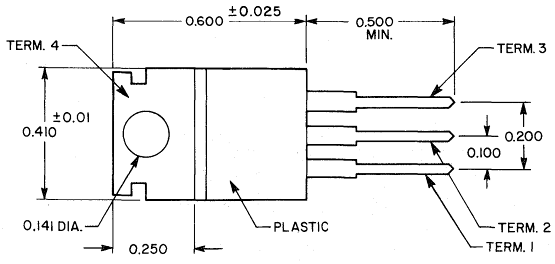
* Only hardware required for isolated-stud package.
Maximum torque: 150 in-lb (1.73 kgf-m)

Case-to-Heat Sink Thermal Resistance for Different Mounting Arrangements — 60- and 80-A Triacs

Package	Type of Mounting Employed	Resistance-°C/W
Stud Isolated Stud	Directly mounted on heat sink with or without the use of heat sink compound	0.05 to 0.15

Lead Forms for RCA Plastic Power Packages

TO-220 (VERSAWATT)



Top View

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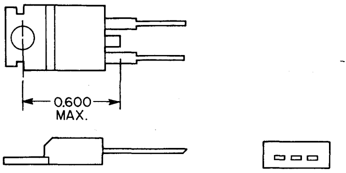
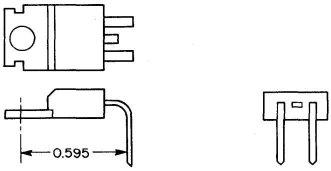
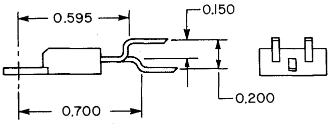
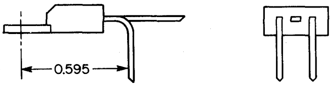
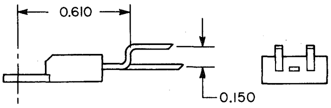
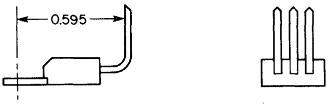
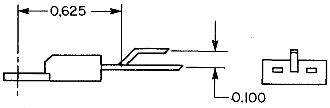
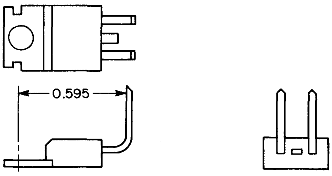
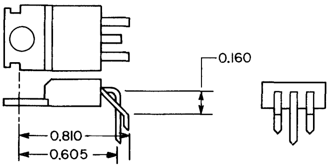
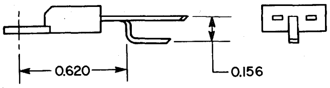
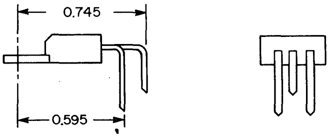
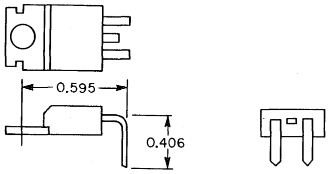
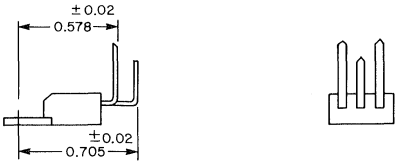
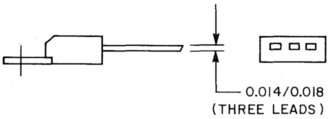
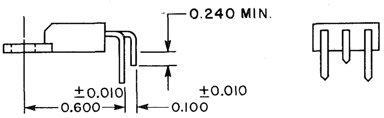
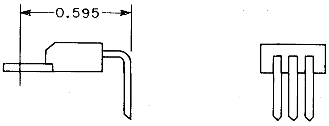
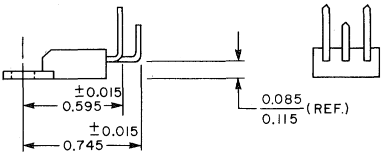
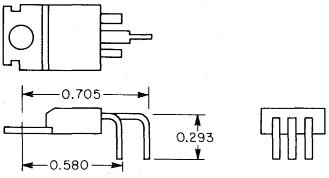
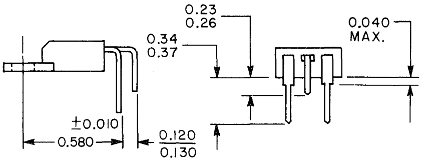
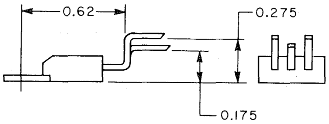
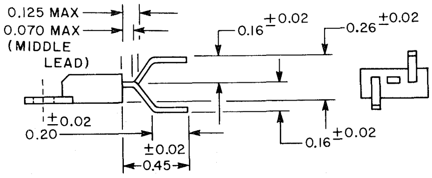
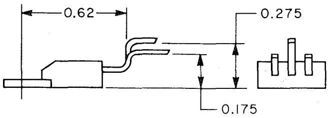
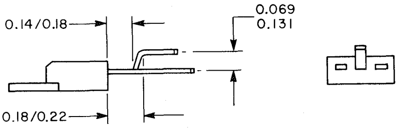
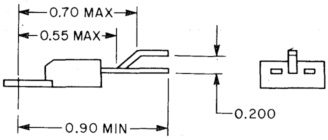
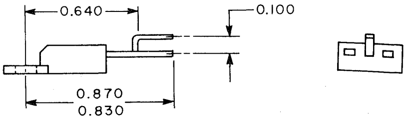
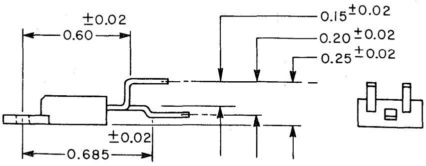
6200		6206	
6201		6207	
6202		6209	
6203		6210	
6204		6211	
6205		6212	

Lead Forms for RCA Plastic Power Packages

TO-220 (VERSAWATT) [cont'd]

Lead Form No.	Outline		Outline
6216		6227	
6217		6231	
6220		6233	
6221		6234	
6223		6235	
6224		6237	
6226		6242	
		6245	

Lead Forms for RCA Plastic Power Packages

TO-220 (VERSAWATT) [cont'd]

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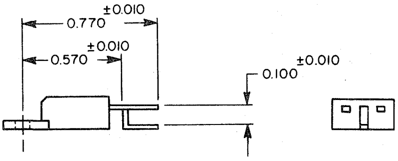
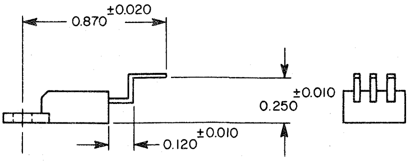
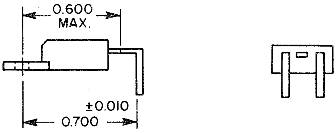
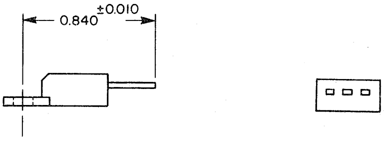
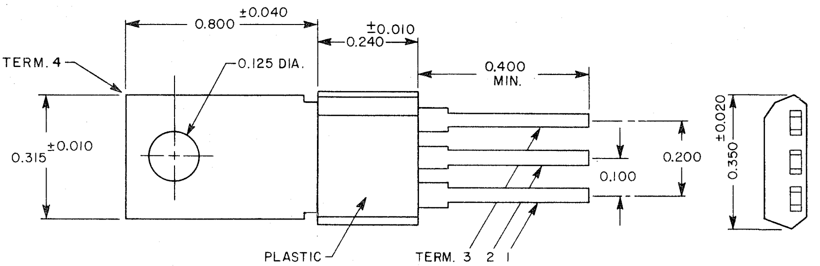
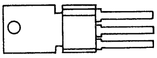
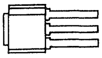
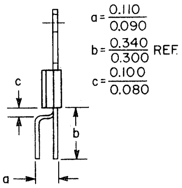
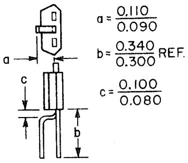
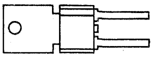
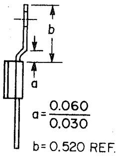
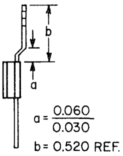
6246		6248	
6247		6249	

TO-202 (VERSATAB)



Top View

Lead Form No.	Outline	Lead Form No.	Outline
Type 1		Type 2	
Type 11		Type 21	
		Type 3	
Type 12		Type 32	

Application Note Abstracts

Power Transistors

AN-3065 . . . . 12 pages
Silicon Transistors for High-Voltage Applications

Several applications for n-p-n high-voltage silicon transistors featuring high-frequency response, fast switching speeds, and low cost are discussed (RCA types 2N3583, 2N3584, 2N3585, 2N3439 and 2N3440). The applications include a series voltage regulator, a switching regulator, inverters, a magnetic deflection circuit, a line-operated audio amplifier, and an operational amplifier.

AN-3565 . . . . 4 pages
A 100-Watt, 18-KHz Inverter Using RCA-2N5202 Silicon Power Transistors

A two-transistor, two transformer inverter that demonstrates the excellent switching capabilities of the RCA-2N5202 power transistor is described.

AN-4124 . . . . 8 pages
Handling and Mounting of RCA Molded-Plastic Transistors and Thyristors

Detailed guidelines for handling and mounting plastic-packaged RCA power transistors and thyristors are given. Types of packages and suggested mounting hardware to accommodate various mounting arrangements are described. Recommendations are made for handling packages during the forming of leads. Various mounting arrangements, thermal considerations, and cleaning methods are described. This information is intended to supplement the data on electrical characteristics, safe operating area, and performance capabilities in the technical bulletin for each type of plastic-packaged transistor or thyristor.

AN-4509 . . . . 8 pages
Compact 5-Volt Power Supplies Using High-Voltage Power Transistors

The use of low-cost, industrial-type, high voltage power transistors and fast-recovery rectifiers to achieve size and weight reductions and efficiency improvements in 5-volt dc power supplies with output currents of 50 amperes or more are discussed. The supplies described, like those used in high-reliability aerospace applications, use switching rather than dissipating regulators to eliminate the need for a 60-Hz power transformer and heat sinks for the transistors. A complete switching-regulator power supply is described in detail.

AN-4558 . . . . .12pages

A regulated constant-voltage power supply that uses integrated circuits and a rugged hometaxial-base transistor to attain high output-power capability is described. A 20-volt, 3-ampere supply that uses a single RCA-2N3055 pass transistor is described in detail; the discussion includes circuit descriptions, operating characteristics, component specifications, and suggestions for layout and construction. Thermal-fatigue effects and safe operating conditions for power transistors are considered. Guidance is provided for those who may want to develop a similar circuit.

AN-4573 . . . . 6 pages
Testing for Forward-Bias Second Breakdown in Power Transistors

The design of a non-destructive forward-bias second-breakdown test facility that determines the forward-bias second-breakdown safe-operating locus for power transistors is described. Detailed schematic diagrams of test circuits that can be used to test devices with collector-current ratings up to 2.5 amperes and sustaining collector-to-emitter voltage [$V_{CEO}(sus)$] ratings up to 300 volts, or with ratings to 5 amperes and 100 volts, are given.

AN4612 . . . . 4 pages
Thermal-Cycling Rating System for Silicon Power Transistors

The basic causes of thermal fatigue in silicon power transistors are analyzed, and a rating chart that makes it possible for a circuit designer to avoid such failures during the operating life of his equipment is described. Examples are provided on the use of this chart to determine the transistor operating conditions required to assure a desired thermal-cycling capability and to determine whether the thermal-cycling capability is adequate for the requirements of a given application.

AN-4673 . . . . 6 pages
A 750-Watt Three-Phase Frequency Converter

A frequency converter with an output frequency ranging from 380 Hz to 1250 Hz that delivers up to 750 watts of three-phase power at 120 or 208 volts rms is described. The circuit, useful in military equipment that uses three phase, 400-Hz power, and industrial plants and laboratories that require power at a variety of low frequencies, makes use of a three-phase bridge inverter supplied from a rectified line; the input can be single-phase or three-phase, 120 volts or 208 volts, at any frequency from 47 Hz to 1250 Hz. The RCA-2N5805 power transistor is used in the circuit.

AN-4783 . . . . 8 pages
Thermal-Cycling Ratings of Power Transistors

A testing program used to determine the capability of the design of an RCA-2N3055 power transistor to withstand thermal cycling over a wide range of operating conditions is described. A sufficient number of tests were performed to verify a rating chart that can be applied by an equipment designer to any practical operating condition. The discussion covers a brief description of thermal fatigue, a method of "scaling the environment" to determine the proper test conditions, specialized test equipment and techniques that assure that the proper stresses were applied to the transistor, and the test results and predicted-capability chart for the transistor.

AN-6145 . . . . 8 pages
A Test Set for Nondestructive Safe-Area Measurements Under High-Voltage, High-Current Conditions

The determination of the safe-operating area of power transistors at high volt/ampere products under pulsed and repetitive-pulsed conditions, nondestructively, is made possible by the test set described in this Note. System philosophy, design, construction, and operation are detailed.

AN-6163 . . . . 12 pages
Quantitative Measurement of Thermal-Cycling Capability of Silicon Power Transistors

This Note discusses the methods used to test the thermal-cycling capability of power transistors. A brief description of thermal fatigue, application requirements, and rating charts is given. A detailed discussion of the practical design and construction of thermal-cycling racks is also included along with actual test conditions for various power transistor types. Acceleration factors, failure indicators, failure mechanisms, and real-time control of thermal-cycling capability of factory products are discussed. Some information is also given on hermetic versus plastic-package thermal-cycling reliability.

AN-6195 . . . . 8 pages
A Switching Regulator Using An RCA p-n-p Power Darlington Transistor

A 20-kHz switching regulator that employs an RCA8350B, a p-n-p Darlington transistor, and that operates from a 28-volt supply is described. The regulator has a regulated output between 4 and 16 volts dc and features overload protection that limits the current to about 11 amperes. The regulator does not operate at a fixed clock frequency, but is free-running.

AN-6215 . . . . 6 pages
Interpretation of Voltage Ratings for Transistors

The basic voltage-breakdown mechanisms of power transistors and the relationship of these mechanisms to external circuits are described—transistor voltage breakdown is a function of both individual device characteristics and associated circuits. The mechanisms described are used to explain the various types of voltage ratings used by transistor manufacturers.

AN-6249 . . . . 6 pages
Real-Time Controls of Silicon Power-Transistor Reliability

This Note compares the traditional, classical approach to the reliability-assurance testing of power transistors with a newer classification of testing: Real-Time Control, RTC. The classical approach is commonly referred to as Group B, and involves a series of mechanical, environmental, and life stress tests. RTC involves a continuous, systematic evaluation and control in "real time" of basic, potential failure mechanisms. It is an important supplement to a total program of reliability assurance.

AN-6272 . . . . 6 pages
Characteristics of RCA Monolithic Power Darlingtons

The design and application of RCA monolithic power Darlington transistors is described. The Darlington circuit has been in use for some time in applications where high beta is needed, but has only recently been available as a monolithic device. The RCA Power Darlington series 2N6385 consists of n-p-n circuits that can be driven directly from an integrated circuit and that operate at currents up to 10 amperes and voltages ranging from 40 to 80 volts.

Application Note Abstracts

AN-6281 . . . . 6 pages

Accurate Measurement of Sustaining Voltage of Power Transistors — A Pulsed-Breakdown Test Set

Several techniques for the measurement of the primary (sustaining) breakdown voltage of power transistors are in common use today. The characteristics and limitations of these test methods frequently make rapid and accurate sustaining-voltage readings on power transistors difficult or impossible. The test set described in this Note fills the need for accurate, laboratory-type, sustaining-voltage measuring equipment, although circuitry used in the test set design may be adapted to high-speed testing equipment as well. A complete parts list and calibration sequence are given.

AN-6297 . . . . 2 pages

Biasing Circuit for the Output Stage of a Power Amplifier — The V_{BE} Multiplier

A biasing circuit, the V_{BE} multiplier, for the output stage of a power amplifier is described. The V_{BE} multiplier provides proper bias for the output transistors of the amplifier under all operating conditions.

AN-6320 . . . . 8 pages

Radiation-Hardness Capability of RCA Silicon Power Transistors

The types of radiation damage that might be experienced by a power device and the tests used to determine the design most effective in preventing these types of damage are described.

AN-6330 . . . . 12 pages

A Safe-Area Rating System for Power Inverters Handling Capacitive and Inductive Loads

Although transistor power inverters have classically been evaluated with resistive loads, the reliability of practical inverters often depends on inductive and capacitive loads and associated starting transient considerations. This Note describes a safe-area rating system for transistors and relates this system to self-excited single-transformer, self-excited double transformer, and driven inverters operating into resistive, capacitive, and inductive loads under both steady-state and starting conditions.

AN-6400 . . . . 16 pages

Operating Conditions Experienced by Transistors in TV Horizontal-Deflection Circuits

This Note is a compilation of equations used to calculate the operating conditions experienced by the output transistor in various types of deflection circuits, circuits that provide horizontal (line) deflection of the electron beam in TV picture tubes employing magnetic deflection yokes. The circuits treated include direct-drive circuits and those in which taps and auxiliary windings on the flyback transformer are employed to provide impedance transformation and yoke voltage reduction. Derivations of the various equations, the simplified as well as the rigorous forms, are provided in Appendixes. Relationships for calculating the "worst case" voltage conditions are given. Operating conditions as measured in experimental circuits are compared with those calculated by means of the equations provided in this Note.

AN-6432 . . . . 8 pages

2-Kilowatt Stepped Sine-Wave Inverter

Recent advances in high-power semiconductor technology, complemented by the capabilities of existing digital integrated circuits, have made possible the economical design of a stepped sine-wave inverter in the multikilowatt range. This Note describes the use of the 2N5578 power transistor in a 2-kilowatt, 60-Hz, stepped sine-wave inverter.

AN-6423 . . . . 8 pages

Thirty-Watt (RMS) True Complementary — Symmetry Audio Amplifier Using BDX33 and BDX34 Darlington Transistors

Monolithic-silicon Darlington transistors designed for low- and medium-frequency power applications are especially suitable for audio-output applications. This Note describes the design and performance of an audio amplifier that incorporates such devices.

AN-6425 . . . . 8 pages

Automatic Analyzer for Determining Safe Operating Area of Power Transistors

The safe operating area is one of the most important ratings of a power transistor, yet only a few methods exist to evaluate it. The method presented in this Note allows description of the safe operating area for both dc and pulse operation without subjecting the transistor to breakdown. Both n-p-n and p-n-p transistors in hermetic or plastic packages can be evaluated, and the complete safe-area curve can be automatically described in a short time.

AN-6605 . . . . 16 pages

Application of RCA Power Devices in Off-Line, High-Frequency Inverter/Converter Circuits

The current trend in power inverter/converter design is to use high-frequency switching techniques and direct operation off the available utility lines (i.e., 110 or 220 volts). The use of higher operating frequencies reduce the magnetic materials required and the size of the filter capacitors. This Note discusses the use of RCA power transistors and SCR's in selected high-frequency inverter/converter applications.

RF/Microwave Power Transistors

AN-3749 . . . . 6 pages

40-Watt Peak-Envelope-Power Transistor Amplifier for AM Transmitters in the Aircraft Band (118 to 136 MHz)

A broadband amplifier for use in AM transmitters operating in the aircraft communication band (118 to 136 MHz) is described. The uncomplicated design of the unit leaves ample room for adaptation to specific needs. The amplifier is capable of delivering peak envelope power of 40 watts at a modulation of 95 per cent with a collector voltage of 12.5 volts dc. Unmodulated drive of 5 milliwatts is required at the input. The overall efficiency of the amplifier is 48 to 53 per cent and the envelope distortion is less than 5 per cent for an amplitude modulation of 95 per cent.

AN-3755 . . . . 12 pages

UHF Power Generation Using RF Power Transistors

The use of rf power transistors in high-power generating sources that employ multiple transistors, pulse operation, and broadband power amplifiers is discussed. Operational principles for and design approaches to, these applications are presented, and practical and reliability aspects are discussed.

AN-3764 . . . . 12 pages

Microwave Amplifiers and Oscillators Using the RCA-2N5470 Power Transistor

The capabilities and some of the uses of the 2N5470 power transistor in the uhf/microwave amplifiers and oscillators that are the essential building blocks for solid-state microwave, radiosonde, and S-band telemetry equipment are discussed. Device and package construction and reliability considerations are described, along with large and small-signal operation at microwave frequencies. Detailed designs and performance data are given for practical circuits incorporating the 2N5470.

AN-4025 . . . . 6 pages

The Use of Coaxial-Package Transistors in Microstripline Circuits

The design, construction, and performance of two microstripline circuits employing 2N5470 coaxial transistors is described. One circuit is a 1.5-GHz amplifier that can provide 1.5 watts of output power with 8 dB of power gain at 50 per cent collector efficiency; the second circuit is a 2-GHz amplifier that can provide 1.2 watts of output power with 6-dB of power gain at 40 per cent collector efficiency. Microstrip or stripline amplifier circuits employing the 2N5470 coaxial-package transistor can have thermal and electrical performance capabilities equal to those coaxial-line circuits.

AN-4421 . . . . 12 pages

16- and 25-Watt Broadband Power Amplifiers Using RCA-2N5918, 2N5919A, and 2N6105 UHF/Microwave Power Transistors

General design considerations for broadband rf amplifiers are discussed. The design of a 2N5919A amplifier that provides a constant power output of 16 watts with gain variation within 1 dB over a bandwidth of 225 to 400 MHz is also discussed. The 2N5918, 2N5919A, and 2N6105, which feature the stripline package, are examples of improved rf power transistors designed specifically for use in high-power broadband amplifiers operating in this range.

AN-4774 . . . . 4 pages

Hotspotting in RF Power Transistors

"Hotspotting", a localized heating effect that results from local current concentrations in the active areas of a transistor, is discussed. The effect can produce catastrophic thermal runaway, long-term deterioration of performance of a transistor during linear operation (class A or AB), when the device is operated with high collector-supply voltage, or when it is operated into a high load VSWR, even though the dissipation is within the limit set by the classical junction-to-case thermal resistance. Hotspot thermal resistance, $\theta_{JS\text{-}C}$, a parameter that can be used in reliability predictions, particularly for devices involved in linear or mismatch service, is examined.

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AN-6010 . . . . 12 pages

Characteristics and Broadband (225 to 400 MHz) Applications of the RCA-2N6104 and 2N6105 UHF Power Transistors

This Note describes basic performance characteristics and specific circuit design details related to the application of the 2N6104 and 2N6105 transistors in broadband uhf power amplifiers intended for use over the frequency band from 225 to 400 MHz. The circuit designs shown in this Note employ 2N6105 transistors; however, equivalent performance can be achieved when 2N6104 transistors are used provided that adequate consideration is given to the mechanical differences of the package.

AN-6084 . . . . 8 pages

High-Power Transistor Microwave Oscillators

This Note describes an approach to the design of transistor microwave power oscillators that may be considered an extension of the more familiar technique used in the design of large-signal class C power amplifiers. The approach has resulted in the design of L- and S-band power sources that provide 1 to 10 watts of output power. These high efficiency power sources exhibit low residual FM noise and very good frequency stability, and are adaptable to voltage-tuning and phase-locking techniques.

AN-6126 . . . . 6 pages

60- and 100-Watt Broadband (225-to-400 MHz) Push-Pull RF Amplifiers Using RCA-2N6105 VHF/UHF Power Transistors

The use of 2N6105 transistors in push-pull rf power amplifiers designed for operation over the frequency range from 225 MHz to 400 MHz is described. The design and performance of a basic single-stage push-pull amplifier and the use of combined pairs of this basic circuit to obtain higher output-power levels are explained. An improved version of the basic push-pull circuit is also described.

AN-6291 . . . . 6 pages

Microwave Transistor Oscillators

Bipolar-transistor oscillators are important components in many communications, test, and military systems. These transistor sources, which feature low residual FM noise, very good frequency stability, and a capability for voltage tuning and phase locking, are available in a wide range of options: fundamental oscillators, frequency doublers, and frequency multipliers. Power outputs range from the milliwatt level to much higher power levels. Bipolar oscillators are less sensitive to spurious modes than IMPATT and TRAPATT diode oscillators. In addition, bipolar devices are rapidly developing a history of high reliability in this frequency range. Therefore, emphasis is placed in this Note on current L- and S-band transistor oscillator techniques.

Power Hybrid Circuits

AN-4483 . . . . 6 pages

General Application Considerations for the RCA-HC2000H Hybrid Linear Power Amplifier

This Note briefly describes the RCA HC-2000H hybrid linear amplifier and discusses such operating considerations as dc and ac power dissipation, efficiency as a function of frequency, protection against excessive load variations and reactive loads, and heat-sink requirements.

Thyristors (SCR's and Triacs)

AN-3469 . . . . 12 pages

Application of RCA Silicon Controlled Rectifiers to the Control of Universal Motors

Typical electric-motor control circuits are discussed along with the characteristics of universal motors. Schematic diagrams of the circuits are given and the advantages and limitations of each circuit are discussed. Speed control by use of phase-angle variations is described.

AN-3551 . . . . 6 pages

Circuit Factor Charts for RCA Thyristor Applications

In the design of circuits using thyristors, it is often necessary to determine the specific values of peak, average, and rms current flowing through the device. This Note contains charts that show several current ratios as functions of conduction and firing angles for some SCR and triac circuits. Examples are given of the use of these charts in the design of half-wave, full-wave ac, full-wave dc, and three-phase half-wave circuits using RCA thyristors. Current and voltage waveforms for the various circuits are included, as are curves of per-cent ripple in load current and voltage.

AN-3659 . . . . 6 pages

Application of RCA Silicon Rectifiers to Capacitive Loads

This Note describes a simplified rating system that allows designers to calculate the characteristics of capacitive-load rectifier circuits quickly and accurately. The effect of the addition of a series limiting resistance to such circuits and the importance of the ratio of the limiting resistance to capacitive reactance are described; curves of rectifier current ratios are presented as functions of the effective ratio. Typical design examples are given, and output-ripple considerations are discussed.

AN-3697 . . . . 8 pages

Triac Power-Control Applications

This Note describes triac operating characteristics and provides guidance in the use of triacs in specific applications: incandescent lamp controls, light-activated controls, motor controls, heat controls, and a proportional integral-cycle control.

AN-3778 . . . . 6 pages

Light Dimmers Using Triacs

A simple, inexpensive light-dimmer circuit that contains a diac, triac, and RC charge-control network is described. The use of the diac to trigger the triac in light-dimming circuits is explained. The basic light-control circuit is introduced and its operation described. In addition, the components added to improve circuit performance are discussed. Three complete circuits and parts lists are shown for 120-volt, 60-Hz operation and 240-volt, 50/60-Hz operation. Mechanical details involved in building the circuits are discussed, and a trouble-shooting chart is included.

AN-3822 . . . . 6 pages

Thermal Considerations in Mounting of RCA Thyristors

Three simple rules to aid the designer in determining heat-sink specifications for a given application are provided. Power dissipation and heat-sink area, the mounting of thyristors on heat-sinks, typical heat-sink configurations, and chassis-mounted heat-sinks are discussed.

AN-3886 . . . . 6 pages

AC Voltage Regulators Using Thyristors

This Note describes a basic ac-voltage regulating technique using thyristors that prevents ac rms or dc voltage from fluctuating more than ±3 percent in spite of wide variations in input line voltage. Load voltage can also be held within ±3 percent of a desired value despite variations in load impedance through the use of a voltage-feedback technique. The voltage regulator described can be used in photocopying machines, light dimmers, dc power supplies, and motor controllers (to maintain fixed speed under fixed load conditions).

AN-4124 . . . . 8 pages

Handling and Mounting of RCA Molded-Plastic Transistors and Thyristors

Detailed guidelines for handling and mounting plastic-packaged RCA power transistors and thyristors are given. Types of packages and suggested mounting hardware to accommodate various mounting arrangements are described. Recommendations are made for handling packages during the forming of leads. Various mounting arrangements, thermal considerations, and cleaning methods are described. This information is intended to supplement the data on electrical characteristics, safe operating area, and performance capabilities in the technical bulletin for each type of plastic-packaged transistor or thyristor.

AN-4242 . . . . 16 pages

A Review of Thyristor Characteristics and Applications

This Note describes the operation, ratings, characteristics and typical applications of thyristors. The basic operation of a thyristor is explained by use of a two-transistor anology. The significance of voltage and temperature ratings is pointed out. Thyristor gate characteristics, switching behavior, and triggering techniques are described. Use of thyristors in typical power-control applications is discussed.

AN-4537 . . . . 8 pages

Thyristor Control of Incandescent Traffic-Signal Lamps

This Note discusses the use of thyristors in the control of traffic signals. The thyristor most applicable to this application is the triac, which can carry the electrical power required for incandescent traffic-light bulbs, yet can be gated by the low-power signals from electronic control timers or monitoring computers. In addition, the triac is able to handle the large transient currents that result from cold filament turn-on (inrush) and filament rupture (flash-over). Triac operation, stresses on triacs in operation with incandescent lamps, and a number of triac circuits for control of incandescent lamps in traffic signal applications are discussed.

AN-4745 . . . . 6 pages

Analysis and Design of Snubber Networks for dv/dt Suppression in Thyristor Circuits

When a triac is used to control an inductive load, voltages with high rates of change (dv/dt) can be generated that can cause a non-gated

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turn-on of the triac. The result is a loss of control of power to the load. The simplest method of suppressing this dv/dt stress is to place a series RC network across the main terminals of the triac. The design of this network, commonly called a snubber network, must take into account the peak voltage that can be allowed in the circuit and the maximum dv/dt stress that the device can withstand. This Note analyzes the RC network design and contains graphs that allow a designer to select a snubber to fit a given application.

AN-6054 . . . . 6 pages
Triac Power Controls for Three-Phase Systems

The growing demand for solid-state switching of ac power in heating controls and other industrial applications has resulted in the increasing use of triac circuits in the control of three-phase power. This Note explains a basic approach to the design of triac control circuits for use in the switching of three-phase power. The basic design rules employed in this approach are outlined, an integrated-circuit zero-voltage switch specifically intended for use in triac triggering is briefly described, and the necessity for, and methods of isolation of, the dc logic circuitry in power controls for three-phase systems are pointed out. Recommended configurations are then shown for power-control circuits intended for use with both inductive and resistive balanced three-phase loads, and the specific design requirements for each type of loading condition are discussed.

AN-6069 . . . . 8 pages
Solid-State Approaches to Cooking-Range Control

As a result of decreasing semiconductor costs, advanced system-cost analysis by appliance manufacturers, and increased consumer consciousness, various solid-state range-control designs can be applied in today's applicance market. This Note presents various solid-state design approaches available to the range-control designer.

AN-6141 . . . . 6 pages
Power Switching Using Solid-State Relays

Solid-state relays make use of a semiconductor device for control of ac or dc power. Since, in most ac applications, the semiconductor element chosen for power control is the triac, this Note describes the triac as a power-switching element. Advantages and disadvantages of the active element over the electro-mechanical relay are discussed in general terms. Basic parameters, such as surge in-rush capability, transient-voltage ratings, suppression network, turn-off consideration and the different modes of triac gating are also discussed. AC power control is covered by various circuit designs for ON/OFF control, zero-voltage switching, and line-voltage isolation.

ICAN-6182 . . . . 28 pages
Features and Applications of RCA Integrated-Circuit Zero - Voltage Switches (CA3058, CA3059 and CA3079

RCA-CA3058, CA3059 and CA3079 zero-voltage switches are monolithic integrated circuits designed primarily for use as trigger circuits for thyristors in ac power-control and power-switching applications. These integrated-circuit switches operate from ac input voltages of 24, 120, 208 to 230, or 277 volts at 50, 60, or 400 Hz. Zero-voltage switches trigger the thyristors at zero-voltage points in the supply-voltage cycle. Consequently, transient load-current surges and radio-frequency interferance are substantially reduced. Zero-voltage switches also reduce the rate of change of on-state current (di/dt) in the thyristor being triggered and can be adapted for use in a variety of control functions by use of an internal differential comparator to detect the difference between two externally developed voltages.

AN-6286 . . . . 8 pages
Latching, Gate-Trigger Circuits Using Thyristors for Machine Control Applications

This Note describes a variety of approaches to the development of a solid-state, latching gate drive for the control of ac loads; the solid-state device used is the thyristor. The solid-state circuits described have fewer undesirable characteristics than electro-mechanical devices and are smaller and lighter.

AN-6288 . . . . 2 pages
Thyristors in Capacitive Discharge (CD) Ignition Systems

This Note describes the requirements of small-engine ignition systems (those deriving electrical energy from a flywheel alternator system), automotive or battery-powered systems, and the ac line-operated igniters. The merits of both capacitive and inductive systems are compared. Both systems are described in terms of performance and limitations. Practical circuits are shown.

AN-6452 . . . . 16 pages
A New Practical Fuse-Thyristor Coordination Method

This Note describes the possibilities of protecting a semiconductor by fusing—when and how a fuse can be used and how much protection is afforded. Cases for which fuse protection is not possible, or for which only partial protection is feasible are also discussed. Fuse selection methods are described.

AN-6456 . . . . 12 pages
Characteristics and Applications of RCA Fast-Switching ASCR's

Silicon controlled rectifiers (SCR's) used in applications such as inverters, choppers, and radar pulse modulators at switching frequencies up to 30 kHz require high di/dt and dv/dt capabilities and very short turn-on and turn-off times. This Note explains SCR characteristics required for fast-switching applications, describes a new type of fast-switching SCR, the asymmetrical silicon controlled rectifier (ASCR), and discusses the application of this new type of SCR in induction cooking ranges.

AN-6457 . . . . 20 pages
Characteristics and Applications of RCA Gate-Turn-Off Silicon Controlled Rectifiers

This Note provides basic information on the theory, special operating considerations, and applications of GTO devices with particular attention given to the RCA G5001, G5002, and G5003 series of 8.5-ampere types. First, GTO devices are compared with conventional silicon controlled rectifiers (SCR's) and power transistors. The basic theory of operation of GTO silicon controlled rectifiers is then explained, and significant ratings and characteristics for these devices are discussed. Guidance is also provided on the use of GTO's in circuit applications, and a number of typical applications are examined.

AN-6578 . . . . 4 pages
Fly-Back Converter Using RCA G5000-Series GTO SCR

This Note describes the use of the RCA-G5001E gate-turn-off (GTO) SCR in a 150-watt, off-line-driven fly-back converter. The fly-back converter and GTO drive circuit are discussed.

AN-6605 . . . . 16 pages
Application of RCA Power Devices in Off-Line, High-Frequency Inverter/Converter Circuits

The current trend in power inverter/converter design is to use high-frequency switching techniques and direct operation off the available utility lines (i.e., 110 or 220 volts). The use of higher operating frequencies reduce the magnetic materials required and the size of the filter capacitors. This Note discusses the use of RCA power transistors and SCR's in selected high-frequency inverter/converter applications.

AN-6628 . . . . 8 pages
Design and Application of High-Power Ultrasonic Converters Using ASCR's

Asymmetrical SCR's with maximum turn-off times of 4 microseconds make possible high-power ultrasonic converters operating at 10 kilowatts at a very competitive price. This Note describes the ASCR structure, explains the basic design principles of an ASCR converter, and discusses the application of this converter to electronic arc-welding equipment and industrial power supplies.

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	Hamilton Avnet Int'l **(Canada) Ltd.**, 2670 Paulus Street, St. Laurent, Quebec H4S-1G2	(514)735-6393
	Cesco Electronics Ltd., 24 Martin Ross Avenue, Downsview, Ontario M3J-2K9	(416)661-0220

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	Electro Sonic Inc., 1100 Gordon Baker Road, Willowdale, Ontario	(416)494-1666
	Hamilton Avnet Int'l (Canada) Ltd., 6291-19 Dorman Road, Mississauga, Ontario L4V-1H2	(416)677-7432
	Hamilton Avnet Int'l (Canada) Ltd., 1735 Courtwood Crescent, Ottawa, Ontario K1Z-2B4	(613)226-1700
	L. A. Varah Ltd., 4742 14th Street, N.E., Calgary, Alberta	(403)276-8818
	L. A. Varah Ltd., 2077 Alberta Street, Vancouver, B.C. V5Y-1C4	(604)873-3211
	L. A. Varah Ltd., 1-1823 King Edward Street, Winnipeg, Manitoba R2R-0N1	(204)633-6190
Chile	**Industria de Radio y Television S.A.**, Casilla 1407, Santiago	
Colombia	**Jose E. Marulanda Montoya**, Apartado Aereo 36-97, Bogota	
Denmark	**Tage Olsen A/S**, Teglvaerksgade 37, 2100 Copenhagen	(01)29 48 00
Ecuador	**Elecom, S.A.**, PO Box 9611, Guayaquil	
Finland	**Telercas Oy**, PO Box 2, SF-01511, Vantaa 51	821655
France	**Almex s.a., 48 rue de l'Aubepine, 92160 Antony**	**666 2112**
	Disten S.A., Zone Silic, 80-82 rue d'Arcueil, 94150-Rungis	687 23 13
	Radio Equipements-Antares S.A., 14-16 rue Baudin, 92301 Levallois-Perret	758 11 11
	Tekelec-Airtronic S.A., Cite des Bruyeres, rue Carle-Vernet, 92310 Sevres	027 75 35
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	SASCO GmbH, 8011 Putzbrunn/Munchen, Hermann-Oberth-Strasse 16	(089)46 4061-69
	Spoerle Electronic KG, Otto-Hahn-Strasse 16, 6072 Dreieich	**06103/604-1**
Greece	**Omma Limited**, 11 Voukourestiou Street, Athens 134	**361 8058**
Holland	**Inelco Nederland b.v.**, Joan Muyskenweg 22, Amsterdam 1006	(020)93 48 24
Hong Kong	**Gibb, Livingston and Co.**, PO Box 55	
India	**Comel**, Sandhurst Bridge, 532 Sardar VP Road, Bombay 7 WB	
Indonesia	**NVPD Soedarpo Corp.**, Jalan Veteran Satu 21-22, Jakarta 1/4	
Israel	**Eastronics Limited**, 11 Rozanis St., Tel-Baruch, PO Box 39300, Tel Aviv 61390	03 475151
Italy	**Lasi Elettronica S.p.A., V. Le Lombardia 6, 20092 Cinisello Balsano, Milan**	92 73 578
	Silverstar Limited, 20 Via dei Gracchi, 20146 Milan	4996
Japan	**Okura Trading Co., Ltd.**, 3-6 Ginza Nichome, Tokyo 104	
Korea	**Panwest Co., Ltd.**, CPO Box 3358/ 903-904 Sambo Bldg., Sokong-Dong, Choong-Ku, Seoul	
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Mexico	**Deksa, S.A.**, Avenida Nuevo Leon #159, Mexico 11, D.F.	
	Mexicana de Bulbos, S.A., Michoacan No. 30, Mexico 11, D.F.	
	Proveedora Electronica Industrial, S.A., Apartado Postal 27-599, Mexico 11, D.F.	
New Zealand	**AWA New Zealand Ltd.**, 36-44 Adelaide Rd., PO Box 830, Wellington 2	
Norway	**EGA A/S**, Hjalmar Brantingsvei 6, Oslo 5	22 19 00
Paraguay	**Comp. Com. del Paraguay, S.A.**, Casilla de Correo 344, Asuncion	
Peru	**Arven S.A.**, Av. Jose Pardo 741, B. Miraflores, Lima 18	
Philippines	**Philippine Electronic Ind.**, PO Box 498, Makati, Rizal D-708	
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Singapore	**Edward Eu and Co.**, No. 1 Orchard Rd., 9	
South Africa	**Allied Electric S.A. (Pty) Ltd.**, Box 6090, Dunswart 1508	52-8232/33
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Sweden	**Erik Ferner AB**, PO Box 56, S-16126, Bromma-Stockholm	08/80 25 40
Switzerland	**Baerlocher AG**, PO Box 485, 8021 Zurich	01/42 99 00
Taiwan	**Hwa Sheng Electr. Co.**, 5/F Pong Lai Bldg., 245 Min Chun East Road, Taipei	
Thailand	**Anglo-Thai Eng. Ltd.**, PO Box 18, Bangkok	
Uruguay	**American Products S.A.**, Av. Italia 4230, Montevideo	
Venezuela	**Telereca, C.A.**, PO Box 3975, Caracas	
Yugoslavia	**Avtotehna**, PO Box 5930XI, Titova 36, Ljubljana 61000	317 044
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	ECS (Slough) Ltd., 380/386 **Bath Road, Slough, Berks, SL16JE**	Burnham 64051
	REL Equipment & Components Ltd., Croft House, Bancroft, Hitchin, Herts. SG5 1BU	50551
	Semicomps (Northern) Ltd., East Bowmont Street, Kelso, Roxburghshire TD5 7HN	Kelso 2366
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	Cramer/San Francisco, 720 Palomer Avenue, Sunnyvale, CA 94086	(408)739-3011
	Electronic Supply Corp., 2486 Third Street, Riverside, CA 92507	(714)683-7300
	Elmar Electronics, Inc., 2288 Charleston Road, Mt. View, CA 94042	(415)961-3611
	Hamilton-Avnet Electronics, 575 Middlefield Road, Mt. View, CA 94042	(415)961-7000
	Hamilton-Avnet Electronics, 8917 Complex Drive, San Diego, CA 92123	(714)279-2421
	Hamilton Electro Sales, 10912 W. Washington Blvd., Culver City, CA 90230	(213)558-2020
	Kierulff Electronics, Inc., 2585 Commerce Way, Los Angeles, CA 90040	(213)685-5511
	Kierulff Electronics, Inc., 8797 Balboa Avenue, San Diego, CA 92123	(714)278-2112
	Kierulff Electronics, Inc., 3969 E. Bayshore Road, Palo Alto, CA 94303	(415)968-6292
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	Liberty/San Diego, 8248 Mercury Court, San Diego, CA 92111	(714)565-9171
	G. S. Marshall Company, 9674 Telstar Avenue, El Monte, CA 91731	(213)686-0141
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	Schweber Electronics Corp., 3000 Red Hill Avenue, Costa Mesa, CA 92626	(714)556-3880
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	Kierulff Electronics, Inc., 10890 East 47th Avenue, Denver, CO 80239	(303)371-6500
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	Hamilton-Avnet Electronics, 643 Danbury Road, Georgetown, CT 06829	(203)762-0361
	Schweber Electronics Corp., Finance Drive, Commerce Industrial Park, Danbury, CT 06810	(203)792-3500
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Florida	**Cramer/Hollywood,** 4035 North 29th Avenue, Hollywood, FL 33022	(305)945-4176
	Cramer/Orlando, 345 Graham Avenue, Orlando, FL 32803	(305)894-1511
	Hamilton-Avnet Electronics, 6800 N.W. 20th Avenue, Ft. Lauderdale, FL 33309	(305)971-2900
	Schweber Electronics Corp., 2830 North 28th Terrace, Hollywood, FL 33020	(305)927-0511
Georgia	**Cramer/Atlanta,** 6456 Warren Drive, Norcross, GA 30071	(404)448-9050
	Hamilton-Avnet Electronics, 6700 I85 Access Road, Suite 1E, Norcross, GA 30071	(404)448-0800
Illinois	**Cramer/Chicago,** 1911 South Busse Road, Mt. Prospect, IL 60056	(312)593-8230
	Hamilton-Avnet Electronics, 3901 North 25th Avenue, Schiller Park, IL 60176	(312)678-6310
	Newark Electronics, 500 North Pulaski Road, Chicago, IL 60624	(312)638-4411
	Schweber Electronics Corp., 1275 Brummel Ave., Elk Grove Village, IL 60007	(312)593-2740
	Semiconductor Specialists, Inc., 195 Spangler Avenue, Elmhurst, IL 60126	(312)279-1000
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Iowa	**Deeco Inc.,** 2500 16th Avenue, S.W., Cedar Rapids, IA 52801	(319)365-7551
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	Radio Supply Company, 115 Laura, Wichita KS 67211	(316)267-5214
Louisiana	**Sterling Electronics, Inc.,** 4613 Fairfield, Metairie, LA 70002	(504)887-7610
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	Cramer/Washington 16021 Industrial Drive, Gaithersburg, MD 20760	(301)948-0110
	Hamilton-Avnet Electronics, 7255 Standard Drive, Hanover, MD 21076	(301)796-5000
	Pyttronic Industries, Inc., 8220 Wellmoor Court, Savage, MD 20863	(301)792-0782
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	Hamilton-Avnet Electronics, 100 East Commerce Way, Woburn, MA 01801	(617)933-8020
	A. W. Mayer Co., Inc., 38 Border Street, West Newton, MA 02165	(617)965-1111
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Massachusetts . **Sterling Electronics, Inc.,**
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Watertown, MA 02172 .... (617)926-9720
Wilshire Electronics/New England, One Wilshire Road,
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Livonia, MI 48150 .... (313)525-1155
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218 Little Falls Road,
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Hamilton-Avnet Electronics,
113 Gaither Drive,
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Rutherford, NJ 07070 .... (201)935-2120
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Pennsauken, NJ 08110 .... (609)662-4000
Schweber/NJ Electronics,
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Somerset, NJ 08873 .... (201)469-6008
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1111 Paulison Avenue,
Clifton, NJ 07015 .... (201)340-1900

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137 Vermont N.E.,
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Hamilton-Avnet Electronics,
2450 Baylor Drive S.E.,
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3000 South Winton Road,
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Syracuse, NY 13057 .... (315)437-6671
Hamilton-Avnet Electronics,
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Rochester, NY 14623 .... (716)442-7820
Hamilton-Avnet Electronics,
6500 Joy Road,
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Rochester, NY 14623 .... (716)461-4000
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Ohio......... **Cramer/Cleveland,**
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Hamilton-Avnet Electronics,
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Houston, TX 77042 .... (713)780-1771

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	Schweber Electronics Corp., 7420 Harwin Drive, Houston, TX 77036	(713)784-3600
	Sterling Electronics, Inc., 2800 Longhorn, Suite 100, Austin, TX 78758	(512)836-1341
	Sterling Electronics, Inc., 4201 Southwest Freeway, Houston, TX 77027	(713)627-9800
	Sterling Electronics, Inc., 2875 Merrell Road, Dallas, TX 75229	(214)357-9131
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Washington	**Hamilton-Avnet Electronics**, 13407 Northrup Way, Bellevue, WA 98005	(206)746-8750
	Liberty Electronics/Northwest, 5305 2nd Avenue, South, Seattle, WA 98108	(206)763-8200
	Robert E. Priebe Company, 2211 5th Avenue, Seattle, WA 98121	(206)682-8242
Wisconsin	**Arrow Electronics, Inc.**, 434 West Rawson Avenue, Oak Creek, WI 53154	(414)764-6600
	Hamilton-Avnet Electronics, 2975 South Moorland Road, New Berlin, WI 53151	(414)784-4510
	Taylor Electric Company, 1000 W. Donges Bay Road, Mequon, WI 53092	(414)241-4321

RCA Manufacturers' Representatives

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Arizona	**Summit Sales**, 7336 E. Shoeman Lane, Suite 104E, Scottsdale, AZ 85251	(602)994-4587
California	**Bestronics** (San Diego Area), 7827 Convoy Court, Suite 407, San Diego, CA 92111	(714)278-2150
Colorado	**B5, Incorporated**, 7100 Broadway, Bldg. 3-I, Watervleit Business Park, Denver, CO 80221	(303)426-0222
Delaware	**Thomas Associates, Inc.**, (see New Jersey)	
Florida	**G. F. Bohman Associates**, 6900 So. Orange Blossom Trail, Suite 420, Orlando, FL 32809	(305)855-0274
	G. F. Bohman Associates, 3000 N. E. 30th Place, Ft. Lauderdale, FL 33306	(305)772-9824
	G. F. Bohman Associates, PO Box 600, Clearwater, FL 33517	(813)442-5606
Georgia	**Electro-Mech**, 6755 Peachtree/Ind'l Blvd., Suite 109, Atlanta, GA 30360	(404)449-6337
Idaho	**Western Technical Sales, Inc.**, (No. of Boise, see Washington)	
	R^2 Marketing, (E. & So. of Boise, see Utah)	
Illinois	**Kebco**, 75 Worthington Drive, Maryland Heights, MO 63043	(314)576-4111
Indiana	**Southern Sales Corporation**, 3901 W. 86th Street, Indianapolis, IN 46268	(317)299-2992
Iowa	**Lorenz Sales, Inc.**, Suite 302, Executive Plaza, Cedar Rapids, IA 52402	(319)393-6912
Kansas	**Kebco**, PO Box 4806, Overland Park, KS 66204	(913)649-2168
Kentucky	**Southern Sales Corporation**, (see Indiana)	
Louisiana	**Jackson Arnold Company**, (see Texas)	
Michigan	**Nicon Associates**, 3835 W. Eight Mile Rd., Detroit, MI 48221	(313)341-7688
Minnesota	**Comstrand, Inc.**, 6279 University Avenue N.E., Minneapolis, MN 55432	(612)571-0000
Mississippi	**Electro-Mech**, (see Alabama and Tennessee)	
Missouri	**Kebco**, 11722 Studt Lane, St. Louis, MO 63141	(314)569-2660
Montana	**R^2 Marketing**, (see Utah)	
Nebraska	**Lorenz Sales, Inc.**, (see Iowa)	
Nevada	**Summit Sales** (Clark Co., see Arizona)	
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New York	**L-Mar Associates, Inc.**, (Upstate NY) PO Box 7945, Rochester, NY 14606	(716)328-5240
	L-Mar Associates, Inc., 216 Tilden Drive, E. Syracuse, NY 13057	(315)437-7779
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North Dakota	**Comstrand, Inc.**, (see Minnesota)	
Ohio	**Arthur H. Baier Company**, 653 Alpha Drive, Cleveland, OH 44143	(216)461-6161
	Arthur H. Baier Company, 4940 Profit Way, Dayton, OH 45414	(513)276-4128
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Pennsylvania	**Arthur H. Baier Company**, (W. Pa., see Ohio) **Thomas Associates, Inc.**, (E. Pa., see New Jersey)	
South Carolina	**Electro-Mech**, (see Georgia and No. Carolina)	
South Dakota	**Comstrand, Inc.**, (see Minnesota)	
Tennessee	**Electro-Mech**, 1451 Elm Hill Pike, Suite 110, Nashville, TN 37210	(615)256-2516
Texas	**C. T. Carlberg Associates**, (El Paso Area, see New Mexico)	
	Jackson Arnold Company, (Austin, Houston, San Antonio Area), PO Box 42388, Houston, TX 77042	(713)783-7297
	Jackson Arnold Company, 1601 Lupin Lane, Austin, TX 78741	(512)447-1068
Utah	**R^2 Marketing**, 2195 So. 3600 W., Salt Lake City, UT 84115	(801)972-5646
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